American
Journal of Orthodontics
and Oral Surgery
(All rights reserved)

VOL. 26 DECEMBER, 1940 No. 12

Orthodontics

PRESIDENT'S ADDRESS

GREAT LAKES SOCIETY OF ORTHODONTISTS

LIEUT.-COL. HARVEY G. BEAN, L.D.S., D.D.S., TORONTO, CAN.

PRESIDENT Cody, other honored guests, ladies and gentlemen of The Great Lakes Society of Orthodontists:

It is customary to hear the president's address during the regular sessions of the association. To me, the fourteenth president, is given an honor which my thirteen predecessors did not have; that of delivering an address to so many guests as well as to the members. It is axiomatic that honor and privilege imply responsibility, and I feel the responsibility that is mine to avoid tiring our guests by entering into an academic and technical discussion of orthodontic problems.

My first wish is to add my poor but sincere word of welcome to that of President Cody. My next, is to say to the members that great and inspiring sessions are ahead of us as we listen to Rogers, Anderson, Brodie, Box, Tisdall, Watson, Mason, Williams, and others. May we, as orthodontists, profit well from what our essayists and clinicians bring us, because at no time in previous history have we been given the chance that is now ours in Canada and will, we believe, soon be yours in the United States, to use our training in the reactions of the maxillary and mandibular bones to repair and change. No other specialty of medicine or dentistry fits one so well to assist nature in the repair and rehabilitation of the jaws in war casualties.

It is a glorious privilege to rebuild the jaws as well as the hopes and confidence of poor unfortunates who, when first wounded, feel that they will never again want to show their shattered faces to their fellow men. It is a challenge which orthodontists will accept. Let us do all in our power to repair the damage which the lustful dictators are inflicting. Orthodontists, be ready for the call.

Read before the Great Lakes Society of Orthodontists, October, 1940, Toronto, Can.

Until that call comes, because all orthodontists cannot be absorbed immediately, one is performing the best service to his country by carrying on his civil pursuits in true democratic fashion. It is suggested that local study groups of our organization refresh themselves on the technique of treatment in facial wounds of traumatic origin and plan for that teamwork which will be necessary with the plastic surgeon in carrying out such treatment.

You will have noticed from your program that the usual order of the sessions has been changed. Your executive felt that it would be beneficial to the attendance of the meeting if a major paper were presented during the last session and the clinics held Tuesday morning. I hope you will approve this change.

The change in relationship of our organization to the American Association of Orthodontists, gives cause to amend our constitution. You will be asked to consider and vote upon these changes at our first business session. I hope that each and every one will use his analytical powers to the fullest as the amendments are placed before him, but please also act in this matter in a spirit of helpfulness and tolerance. Cases have been known, not in our organization of course, where an attempt to amend the constitution almost severed friendships of years.

It has been customary in the past, for the presidents of the organization to do some work in preparing for the annual meeting. In fact they have worked very hard at this task. This year will see what I believe to be the finest program we have had, and general arrangements that will be pleasing to the most critical, without the president having contributed a single helpful act. How come? It is because others shouldered the load. The executive committee worked a little harder and my confreres in Toronto, who are the finest in the world (and I say that after more than twenty years' association with most of them), took on any and all tasks asked of them. Especially would I like to mention the action of Doctors Fisk and Crouch who, each knowing full well the work entailed, undertook to relieve me of all details in connection with this meeting so that there would be no diversion of time or thought from my military duties.

My grateful thanks to each and every one who has worked on my job, or his own, in order to arrange for an outstanding meeting.

As I write these words Britain is a beseiged fortress, fighting magnificently for her life—and ours. Stirred to the depths of our souls by her superb heroism, we realize the literal truth of Mr. Churchill's epic phrase; "Never before in history has so much been owed by so many to so few." Yet even in this hour of dire testing in defense, it is heartening to know that the leaders think and plan in terms of offensive warfare. Defense alone can never win a war. The best strategy is advance. Let us also firmly and surely continue to advance.

MALOCCLUSION IN A GROUP OF POSTRACHITIC AND NONRACHITIC ADOLESCENT CHILDREN

BERT G. ANDERSON AND VEIKKO O. HURME, NEW HAVEN, CONN.

IT IS the purpose of this presentation (1) to report on the occlusal deformities found in a group of young adults, the majority of whom were known to have had rickets in early childhood and (2) to review in more detail the findings in three patients, two of whom suffered unusually severe and prolonged attacks of rickets.

Hatfield[5] reported the results of a study of occlusions in a group of children that showed characteristic deformities of rickets and in whom a clear diagnosis of the disease had been made. According to him, "A careful study of each case seems to show nothing in the nature of jaw formation which might be called characteristic of the disease, and instead of the narrow or V-shaped and high vaulted palate, the arch forms seemed well within the limits of the normal." Friel[4] investigated the effect of the war diet on the teeth and jaws of the children of Vienna and came to the conclusion that no more malocclusion occurred among these children with a high incidence of rickets than he had observed in Irish children. After discussing the findings of these and other workers, Brash[1] states, "It is improbable that many are now likely to take the facile view that irregularity and malocclusion are manifestations of rickets as such. It is too obvious that there is no direct relation between them." Although our findings do not support the latter statement, in the main they agree with those of the above-mentioned writers, who have done much to dispel the earlier conception that rickets is a common cause of malocclusions in general.

This report of occlusions found in a group of postrachitic and nonrachitic adolescent children is the result of a cooperative study conducted by the Children's Bureau of the Department of Labor at Washington, D. C., and members of the staff of the School of Medicine at Yale University, New Haven, Conn. The group was comprised of thirty-three children who had had rickets to a moderate or marked degree and of eleven in whom no evidence of the disease was found. All in whom a diagnosis of rickets was made received antirachitic treatment.

The medical records of two previous studies of these individuals were available for this investigation. The first was conducted by the Children's Bureau in collaboration with the Department of Pediatrics of the School of Medicine at Yale during the years 1923-1926. Four hundred and eighty infants were studied at intervals from the time their birth certificates were filed until they reached ages between twelve and thirty-six months. A follow-up study was made during the winter of 1931-1932, reported by Eliot and collaborators,[2] but no mention was made of the findings pertaining to occlusion. One hundred of the original group were again brought back for exam-

From the Department of Surgery, Yale University School of Medicine, New Haven, Conn., in collaboration with the Children's Bureau, Department of Labor, Washington, D. C.
Read before the Great Lakes Society of Orthodontists, October, 1940, Toronto, Can.

ination and follow-up studies during the winter of 1938-1939. Forty-four individuals available for this report had plaster models made as a part of the dental record during the previous examination.

For purposes of this study, dentitions that satisfied the functional requirements suggested by Johnson[6] were considered to be normal. When the function of mastication or speech was impaired, or the form, alignment, or articulation was such as to mar the appearance of the person, the teeth were considered to be in malocclusion. To quote Johnson, "We are concerned with occlusion in its relation to the functional activities of the entire organism. Comparative study of the occlusal relations of the teeth of many individuals is a basis upon which to build and it is nothing more. . . . The problem of normal occlusion is in the last analysis a physiological problem. The reference to a certain condition as normal occlusion means that there exists a relation of the teeth in function that will help to establish and maintain in its most stable form the organization of the individual organism. It does not necessarily mean perfection in the surface relations of the teeth."

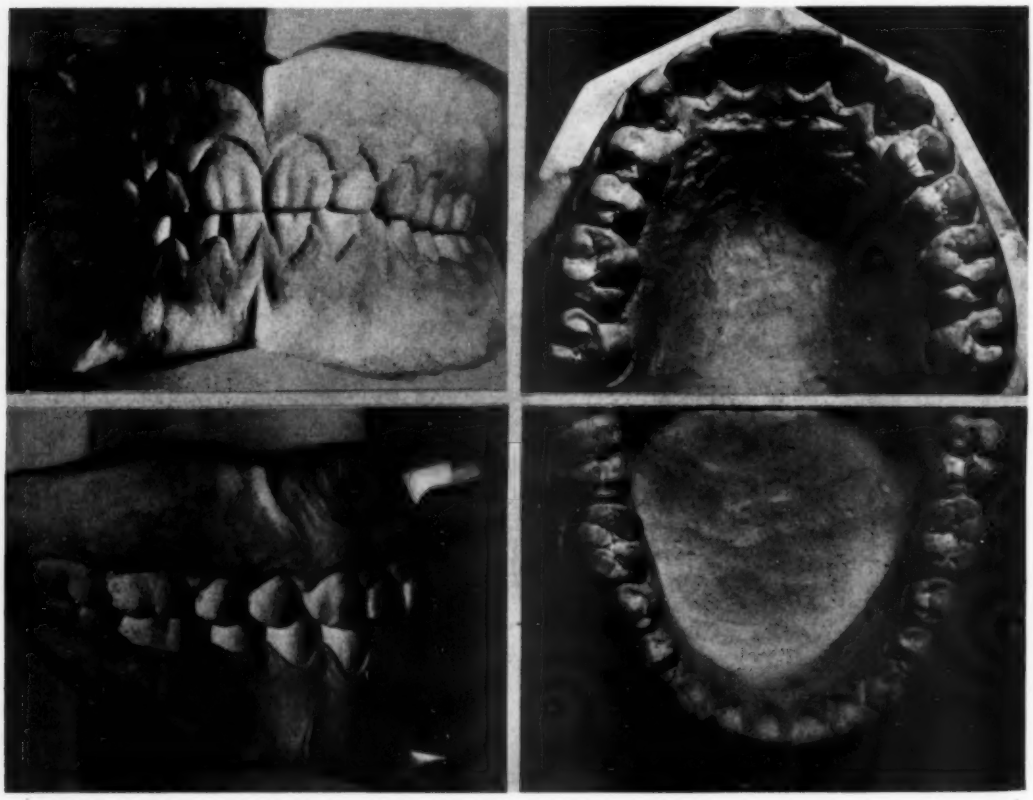


Fig. 1.—Plaster model of dentition considered as an anatomically and functionally good occlusion.

Four of the forty-four persons had what were considered to be anatomically and functionally good occlusions (Fig. 1). One of these had had severe rickets and the other three a moderate form of this disease. In five additional ones occlusal conditions were satisfactory (Fig. 2), although small defects such as slightly rotated or displaced teeth were present.

Of the thirty-five individuals with occlusions that were anatomically and functionally deficient, twenty-two were thought to be related to systemic disorders, the remaining thirteen to local injury (Fig. 3). The local injuries were assumed to be the result of dental caries, although it was difficult to determine in every case with certainty whether or not a missing tooth had been extracted because of caries. Two persons who had suffered unusually severe and prolonged rickets had malocclusion as the result of developmental defects of the teeth (Fig. 4). Five individuals showed malalignment of teeth apparently not due to disproportion between the teeth and jaws. Eight of the entire group of forty-four exhibited some degree of spacing, the result of disproportion between the teeth and jaws (Fig. 5).

Only three of the group of twenty-two cases, classified as associated with systemic disturbances, showed any crowding. The condition was marked in only one of these and only in the mandibular incisor region. (It may be important to recall here the racial derivation of these individuals, particularly the large percentage of negroes.) Only three of the afore-mentioned twenty-two showed a posterior position of the mandible (Fig. 6). In five of the twenty-two cases there was an open-bite ranging from an edge-to-edge condition to a twelve mm. opening between the opposing incisors (Fig. 7). Of the five cases with this condition two had had moderate and three severe forms of rickets. The open-bite was the most severe deformity found in the entire group. The photograph shown in Fig. 7*D* is of the most marked case encountered.

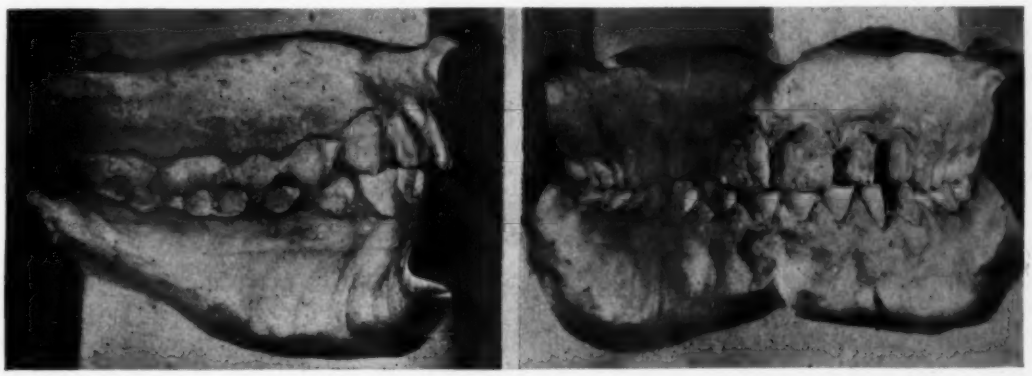


Fig. 2.—Plaster model of dentition considered to have satisfactory occlusion, although some teeth were slightly rotated or displaced.

In contrast to the case described above is the one shown in Fig. 8. In this instance the whole mandible is in anterior relation to the maxilla. A full complement of teeth is present in the maxilla. The mandibular right first molar has been missing for a considerable length of time, as shown by the marked drift of teeth into the space formerly occupied by the missing molar. This condition, however, has not significantly lessened the deformity. (Assuming that the missing tooth was extracted, it is improbable that the removal of the molar was intended to be an orthodontic treatment.)

A comparison of the 1932 and 1939 models, excluding the group of local injury cases, yielded interesting results. It was possible to compare the relative positions of the maxillary first permanent incisors in twenty-four cases where these teeth were present in both sets of models. Nine showed no medial diastema

Fig. 3.—Plaster model of dentition with malocclusion, the result of local injury or extraction.

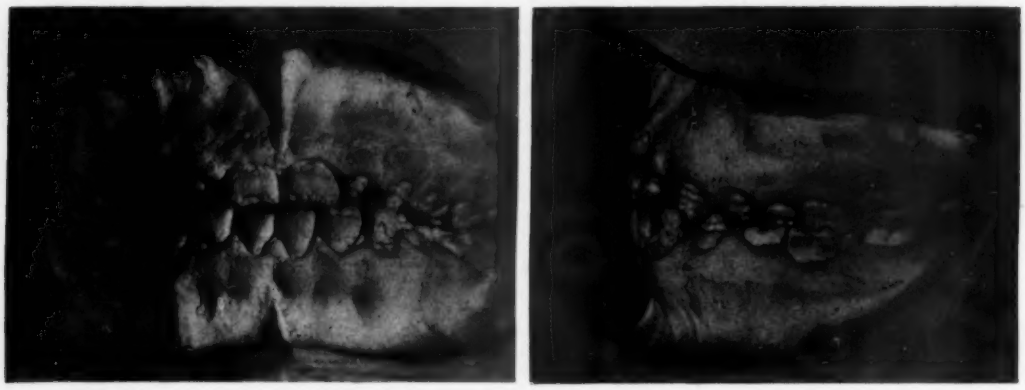


Fig. 4.—Plaster model of dentition with malocclusion, the result of developmental defects of the teeth.

Fig. 5.—Plaster model of dentition with malocclusion, the result of disproportion between teeth and jaws.

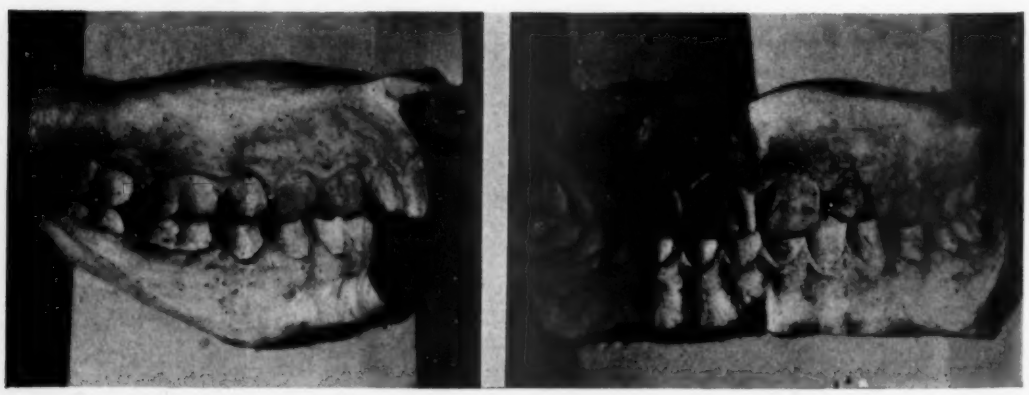


Fig. 6.—Plaster model of dentition with the mandible in posterior position.

either in 1932 or 1939. Of the remaining fifteen, ten showed either a closure or marked diminution of the space (Fig. 9). All of the five cases in which the diastema was unchanged were those in which the anterior teeth were spaced owing to a disproportion between the teeth and jaws.

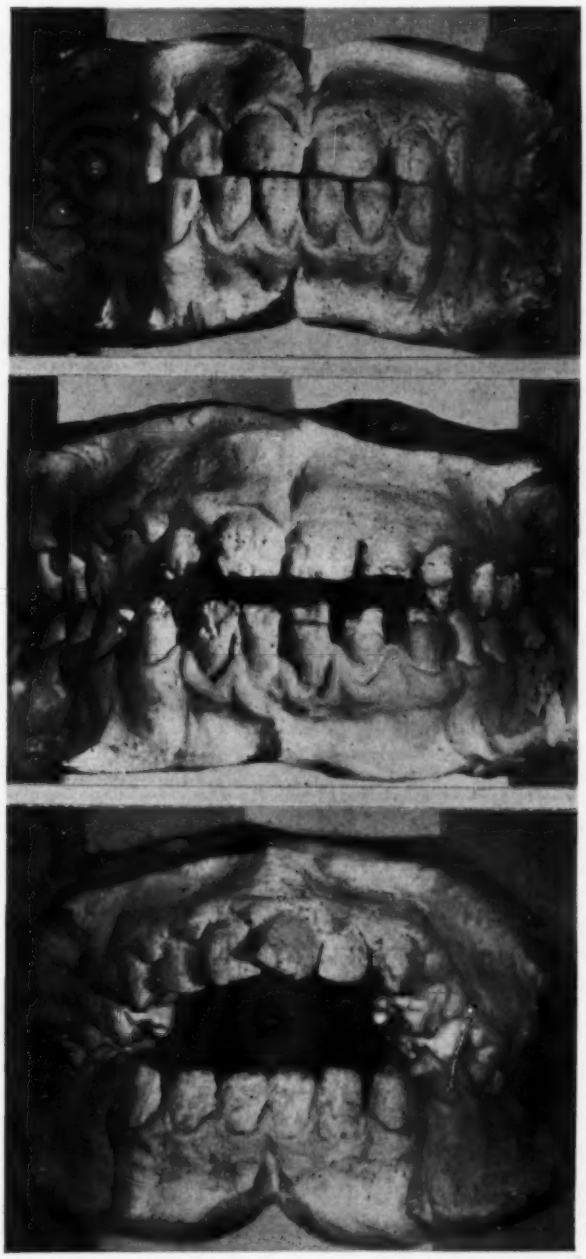


Fig. 7*A*, *B*, and *C*.—Plaster models of dentitions showing various degrees of open-bite.

A large majority of the gross developmental defects recorded in the previously made models were still present in those made in 1939. A striking exception to the rule is illustrated in Fig. 10. This is a photograph of a plaster model made of this dentition in 1932. The patient (Case 1) was 8 years old at the time and had a mixed dentition normal for his age. His maxillary incisors occluded lingually to the mandibular series. During the time between

1932 and 1939 no orthodontic treatment of any kind was attempted. The medical record shows that this patient had a moderate degree of rickets when he was 3½ months old, for which cod liver oil was prescribed. This patient also had other illnesses common to childhood, none of which were considered to be contributory to the malocclusion. The photograph used to illustrate the most perfect occlusion found in the entire group is of the teeth of this patient as seen in 1939 (Fig. 1).

Fig. 7*D*.—Plaster model of dentition with the most severe form of open-bite found in the group.

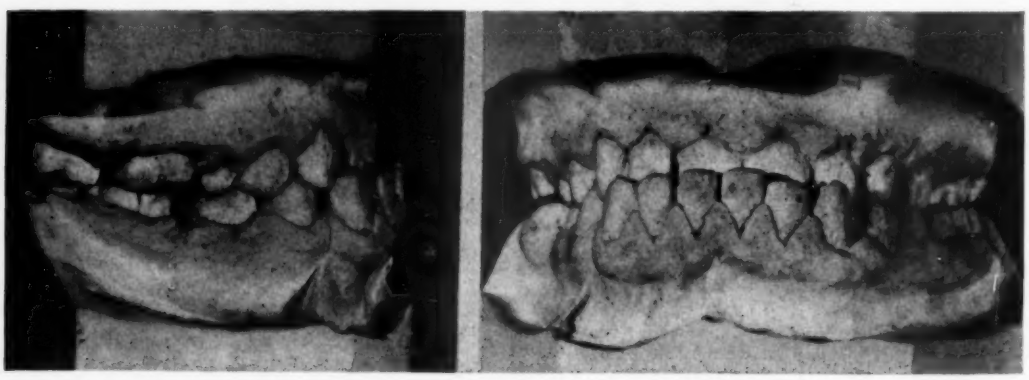


Fig. 8.—Plaster model of dentition with the mandible in anterior position.

Kantorowicz[8] has reported similar observations made over a period of years on developing jaws of children. According to him, this type of malocclusion may occur where a region of the maxilla has been arrested in its development. This portion of the jaw may undergo a delayed corrective growth spurt and result in normal occlusion without local orthodontic treatment. The malocclusions described by him are similar to that shown in Fig. 10.

The cartilaginous portions of growing bones are known to be common sites of rachitic lesions. Although the jaws ossify chiefly as membranous bones, cartilage takes part in the development of both mandible and maxilla (Fawcett[3]). Cartilaginous structures of the face and base of the cranium may also play important roles in the development of the closely associated maxilla. Johnson[7] has shown that a dystrophy of the endochondral structures at the base of the cranium in dogs results in an arrest of the forward growth of the maxilla and

produces a peculiar type of deformity of the jaw seen in the English Bull. He has also suggested that certain deformities in man, characterized by a prominence of the mandible, are in all probability the result of chondrodystrophy in the growth of the cartilage at the base of the skull rather than of an overgrowth of the mandible. Maxillary deformities such as the open-bites found in this group may be the result of rachitic changes occurring in the cartilages during critical periods of development.

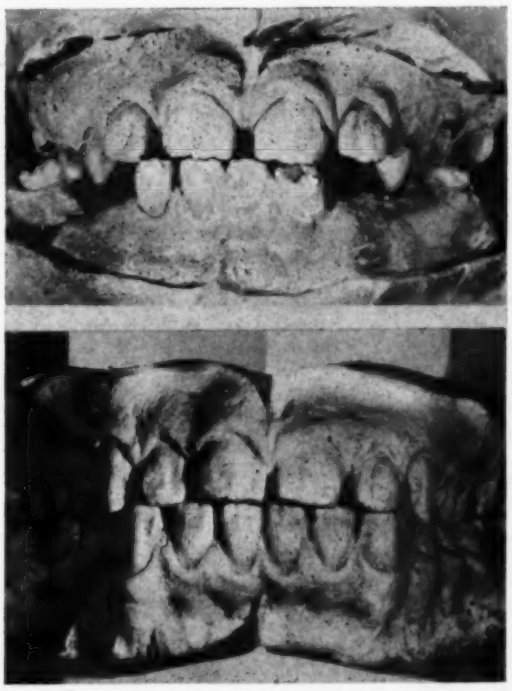


Fig. 9.—Plaster models of dentitions showing reduction of spacing in the midline.

Case 2 is that of a girl 18 years of age, height four feet ten and one-half inches, weight 125 pounds, born Feb. 22, 1922. She was first admitted to the New Haven Hospital in November, 1922, with a diagnosis of tetany, rickets, otitis media, pharyngitis, and abdominal hernia. During hospitalization the patient was subjected to a complete medical study and treated chiefly for tetany and rickets with calcium chloride and cod liver oil. There followed a slow but favorable response to this treatment, and she was discharged to the outpatient clinic in February, 1923. In April, 1923, the patient was treated in the outpatient clinic for bilateral otitis media and an upper respiratory infection. She was brought to the clinic again in October, 1924, at which time a diagnosis of marked rickets, tetany, and scabies was written into her history. Cod liver oil, "as patient has been getting it," was prescribed. According to the record, severe rickets was present when the patient was seen again in October, 1926, at the age of 4 years and 8 months.

During the winter of 1931-32, the patient was in for routine follow-up study. At this time it was recorded that she had "deformities of rickets and marked enamel hypoplasia of all permanent teeth with the possible exception of the third molars" (Fig. 11).

In 1932 the patient was brought in for a psychiatric examination which resulted in a diagnosis of (1) behavior problem, (2) idiopathic convulsions (epileptic), and (3) pediculosis.

She was admitted to the psychiatric ward of the New Haven Hospital in 1936 with convulsions, psychosis and lacerations, and committed to the Connecticut State Hospital in 1937 owing to "convulsions associated with mental retardation on a congenital basis."

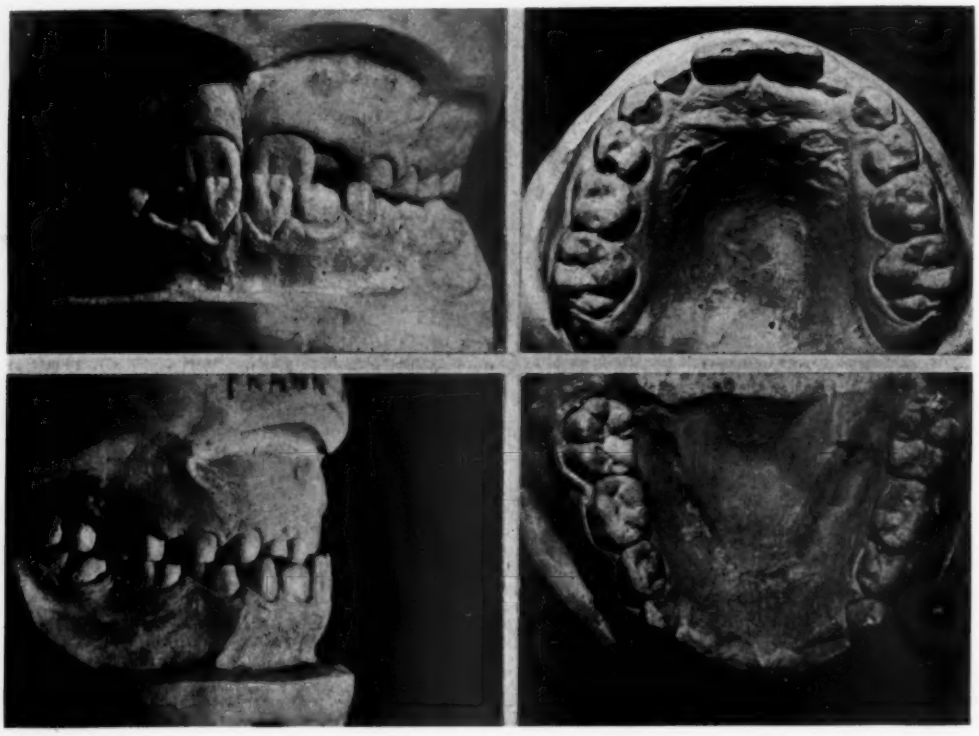


Fig. 10.—Plaster model of dentition of the same patient as in Fig. 1, made eight years earlier.

This patient was subjected again to a complete physical examination during the winter of 1938-1939. Aside from her teeth, the examination showed that she was mentally retarded, epileptic, had skeletal deformities, and showed growth arrest associated with rickets.

All permanent teeth had erupted and were still in good alignment, with the exception of the left maxillary second incisor and canine, which had become displaced somewhat palatally since her previous examination in 1932 (Fig. 12). (This may have been the result of a fall during a convulsion.) All teeth appeared to be supported by well-developed alveolar processes. The examination revealed that all groups of teeth, including third molars, had developmental defects. The only evidence of dental caries was found in the proximal surfaces of the two maxillary first molars. There was present a minimal degree of chronic gingivitis and malocclusion.

This young woman, 18 years of age, suffered from severe rickets for a period of approximately five years during infancy and early childhood, and from convulsions throughout her life. The developmental enamel defect, which is widely distributed over the whole dentition, is evidence of a pro-

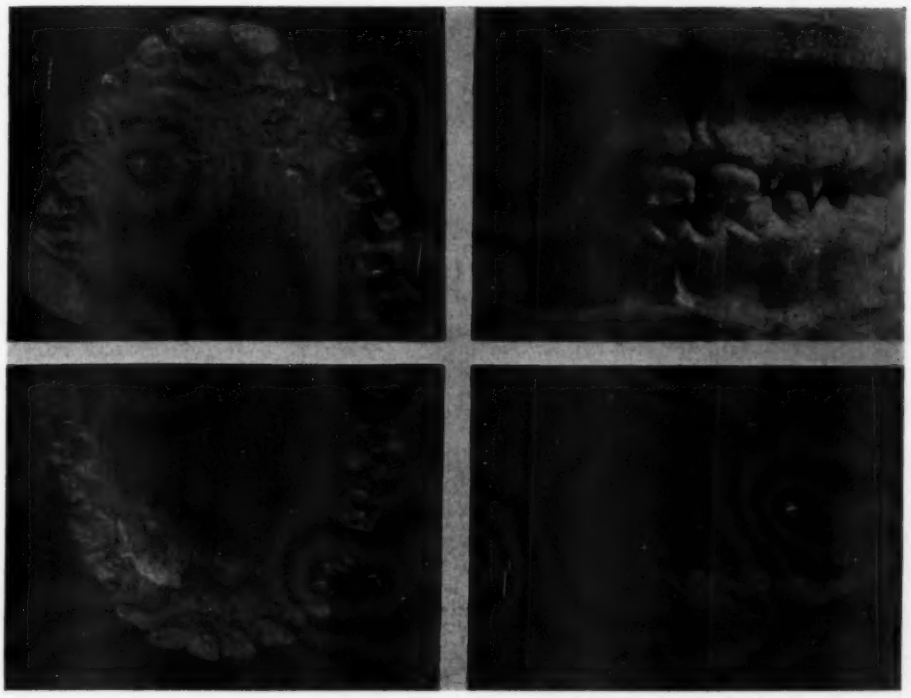


Fig. 11.—Plaster model of dentition of patient who had had severe rickets.

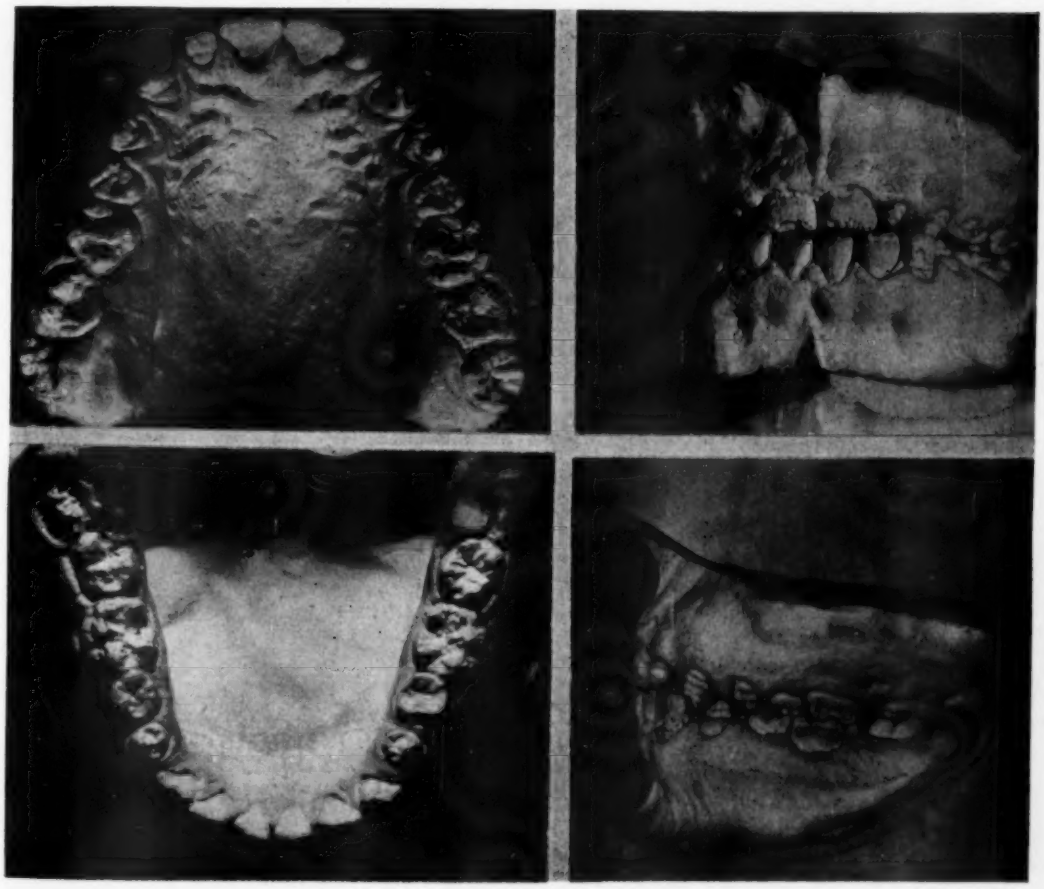


Fig. 12.—Plaster model of dentition of the same patient eight years later.

longed disorder. The plaster models indicate that the alveolar processes are unusually well formed, in good relation to each other and with adequate space for a normal dentition. There is no malocclusion that can be associated with faulty bone development.

Case 3 is that of a 9-year-old boy, height three feet one and one-half inches, weight 35 pounds, who was admitted to the New Haven Hospital on Aug. 1, 1932, for investigation of marked rickets which did not respond to treatment.

The family history was negative and his birth history normal. The patient was breast fed for nine months. He took no cod liver oil until he was 3 years old when he had one dram b.i.d. for one year, none from 4 to 6 years, and one dram t.i.d. from six years to the present time, during the winter months. His physical development was much retarded, but he was mentally alert.

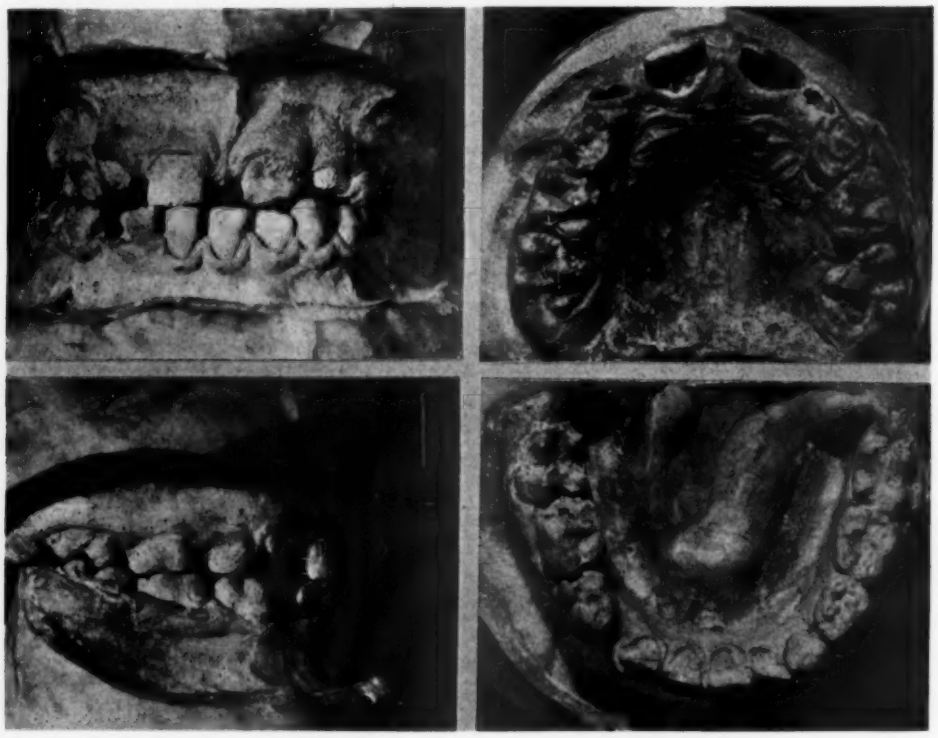


Fig. 13.—Plaster model of dentition of patient with renal rickets.

When he was 18 months old he had cervical adenitis, which suppurated. The abscess ruptured spontaneously, clearing up in two months. Since then the mother noticed that he was subject to frequent sore throats and also showed marked polydipsia, polyuria, and nocturia which persisted. Added to this there was complaint of occasional headaches and dizziness.

The physical examination at the age of 9 years and 7 months showed typical rachitic deformities, a misshapen chest, rachitic rosary, Harrison's groove, potbelly, scoliosis, outward bowing of the femurs, bowleggedness, enlarged epiphyses and the weight and height of a 4-year-old child. On admission to the hospital the spleen was palpable. The nasal margin of the left eye disc was blurred, but otherwise the fundi were negative. The laboratory findings showed a mild anemia, albuminuria, phenolsulphonephthalein test 10

per cent in two hours, inability to concentrate urine above 1.007 or dilute below 1.005, and nonprotein nitrogen 62 mg. per cent. The x-ray of the long bones showed marked rachitic changes with some slight evidence of healing.

There was present a marked developmental defect of the teeth involving all permanent ones that were available for direct inspection and x-ray examination (Fig. 13). A moderate degree of dental caries and a minimal amount of chronic gingivitis were present. It is interesting to note that the jaws and alveolar processes appeared to be well developed and provided ample room for his teeth, which erupted into good alignment despite the severe deformity of the enamel and skeleton. The teeth appeared also to be going through a normal schedule of eruption. Besides the malocclusion due to the enamel defect, there was a slight lateral position of the mandible in relation to the maxilla.

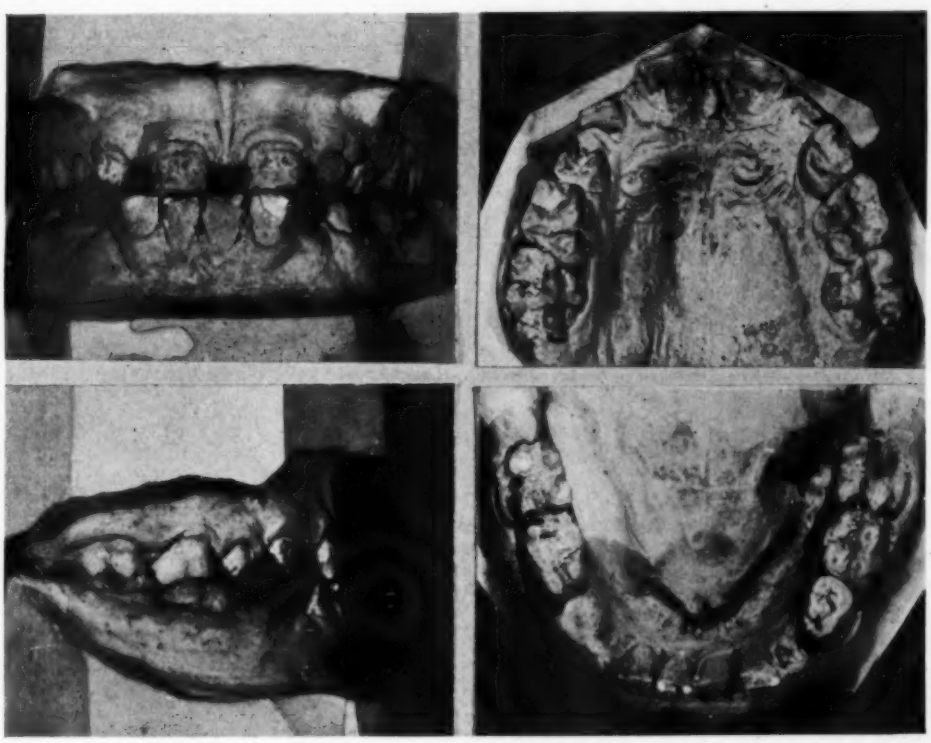


Fig. 14.—Plaster model of dentition of same patient made two and one-half years later.

The course in the hospital was uneventful. After a period of observation, the patient was put on viosterol, 20 min. t.i.d., and sent home, to be followed in the outpatient clinic. Diagnosis: nephritis (chronic glomerular), rachitis (on basis of chronic nephritis).

The dental examination which was repeated when the patient was 11 years and 11 months old (Fig. 14) showed little change in his dentition. During the interim, only three deciduous teeth had been lost and two permanent ones had partly erupted into the oral cavity. There was a definite lag in the teething process. The slight malrelation of the jaws observed during the first examination was still present.

Although a diagnosis of renal rickets was made in this patient, his whole clinical picture was much like that of regular rickets, except for the fact that he did not respond favorably to viosterol treatment. Again, the developmental tooth defect was widely distributed over the whole dentition and was the cause of his chief occlusal deformity. The alveolar processes still appeared to be well formed and in fair relation to each other, with adequate space for a normal dentition. There was no pronounced malocclusion that could be attributed to damaged jaw bones.

The type of developmental deformity of the teeth found by Eliot and coworkers[2] in 34 per cent of a group of children with a history of moderate or marked rickets was sufficiently severe in three individuals of the present series to cause a peculiar type of malocclusion.

The open-bite deformity found in these children may be attributed to the influence of rickets, but this disease did not otherwise give rise to much permanent damage to their jaw bones.

Despite the fact that 75 per cent of these individuals had moderate or severe rickets in childhood, a disease known to produce severe skeletal deformities, there was no significant amount of malocclusion among them.

In reviewing the material as a whole, one is impressed by the presence of a large proportion of fair to good dentitions when requirements of mastication, speech, and appearance are used as criteria. One would expect that a similar investigation of the amount of occlusal deformity found in any arbitrarily selected group of children might show similar results.

REFERENCES

1. Brash, J. C.: The Aetiology of Irregularity and Malocclusion of the Teeth, The Dental Board of the United Kingdom, Colchester, London and Eton, 1931, The Ballantyne Press.
2. Eliot, Martha M., et al.: A Study of the Teeth of a Group of School Children Previously Examined for Rickets, Am. J. Dis. Children **48**: 713, 1934.
3. Fawcett, E.: The Development of the Bones Around the Mouth. In the Growth of the Jaws, Normal and Abnormal, in Health and Disease, pp. 1-22, The Dental Board of the United Kingdom, Colchester, London and Eton, 1924, The Ballantyne Press.
4. Friel, E. Sheldon: The Effect of the War Diet on the Teeth and Jaws of the Children of Vienna, Austria, INT. J. ORTHODONTIA **8**: 539, 1922.
5. Hatfield, Hugh K.: A Preliminary Study of the Effect of Rickets on the Jaws, INT. J. ORTHODONTIA **5**: 367, 1919.
6. Johnson, A. LeRoy: Basic Principles of Orthodontia, The Dental Cosmos **65**: 1923.
7. Johnson, A. LeRoy: The Institutional Factor in Skull Form and Dental Occlusion, AM. J. ORTHODONTICS **26**: 627, 1940.
8. Kantorowicz, Alfred: The Self-Correction of Orthodontic Anomalies, First International Orthodontic Congress, August, 1926, pp. 40-55, St. Louis, 1927, The C. V. Mosby Co.

MYOFUNCTIONAL TREATMENT FROM A PRACTICAL STANDPOINT

ALFRED P. ROGERS, D.D.S., A.M., BOSTON, MASS.

TODAY I am expected to talk to you about the practical side of myofunctional therapy. In order that we may proceed under the best auspices, I am going to ask that you endeavor to change somewhat your mental attitude and think, for the time being, that you are, in reality, orthopedists, but that your orthopedic interests are confined to the human face and the dental apparatus. We shall then be thinking about dentofacial orthopedics, and not orthodontics. I think it was an orthopedic surgeon who first called our attention to the idea of considering the mouth and its parts as a joint consisting of three occluding surfaces, two of them similar in many respects to other synovial joints, but less limited in action, and articulating with the bony skeleton; the third consisting of interdigitated enamel surfaces.[1]

If you will visualize a normal, or a typical joint of this kind, and, at the same time, visualize its varied and numerous motions, as it functions in speaking and in the act of mastication, you become conscious of the very great importance that must be attached to the articulating enamel surfaces; and also you will be particularly impressed with the functioning of the various groups of muscles which must perform many varied and complex movements. And as an orthopedist you become muscle conscious, just as the orthopedic surgeon is muscle conscious, thinking always in terms of muscular action with balances and stresses of so many and various kinds. If again you visualize this human masticatory apparatus, but this time, instead of bringing before your minds the normal efficient masticatory joint, picture perhaps a rather severe case of disharmony in the relations existing between those enamel surfaces which form one of the three points of contact you see at once, when you watch the functioning of this defective joint, that the muscle groups are not functioning as smoothly, or with the same beautiful precision as in the normal picture, and you also observe that the other two joints, the synovial protected points of contact, are, perhaps, not working in a uniform and harmonious manner. If you happen to be of an inquiring mind, you may ask yourself certain questions such as come naturally to the trained orthopedist when he considers deformities in other parts of the body; and you may, perhaps, conclude that hereditary influences might in some instances take the blame for certain unwonted conditions. You also conclude, just as the orthopedist does, that certain maldevelopments come about as a result of an enfeebled musculature, possibly due in some instances, at least, to malnourishment of the cellular elements of nerve and muscle during the growth of the child from infancy. Having thought about the matter in this way, you naturally adopt the orthopedic methods for the correction of whatever anomaly you may be considering, and try as you may, you will be unable, as orthopedists, to forget that the muscles must be given a particular amount of attention, and every effort made to attain, as quickly as possible, a condition

Read before the Great Lakes Society of Orthodontists, Toronto, Can., October, 1940.

known as tonus and balance in these very muscle groups that are not functioning in a smooth and harmonious manner. In some of the malocclusions that you have been visualizing, you notice that the articular enamel surfaces are not at all in their right relationship. The malrelation may be such as to render it impossible for the individual to function in any way except with the mandible in a recessive position. Further orthopedic study very likely will reveal that there are various interferences which the muscular system has been unable to overcome, in its feeble endeavor to function with the parts in normal relationship, and you conclude that, during the growth period of this individual, the muscles have been too weak in their functional operations to overcome the interferences of these enamel organs. It becomes plain to you that these interferences must be removed, in order to allow the muscles to function in their proper relationship, and, when these interferences are removed, that you, as an orthopedist, may then strengthen the various muscular groups, and thus assist in establishing a normal oral joint where the enamel surfaces are articulating properly, and all the living machinery is able to operate in a smooth and normal manner.

If you have followed me with the mental attitude which I hope you have, you are conscious of the widening field of your professional endeavors, and that the matter of adjusting interferences is a mechanical matter to a certain degree—to the degree that any orthopedic appliance functions in assisting the deformed parts back to normal relationship. You are also impressed with the necessity of giving more than casual attention to those muscular engines which are really in control of the functional position, and responsible to a large degree for the form which the hard but more fluid parts assume, namely, the investing bony material. It might be profitable for us, at this point, to hear a quotation from a treatise on orthopedics and try to discover a parallel which will be helpful to us, and perhaps encourage us to think of ourselves, habitually, as being orthopedists. We will turn to that chapter which deals with the treatment of the club foot. Orthopedists agree that the treatment of this deformity should be undertaken during the early weeks of a child's life, and that delay of several months is simple neglect.

"Early treatment consists of frequent gentle manual correction and the employment of some means of retaining the foot in an improved position. Frequently this improved position will become in a few weeks a fully corrected or even an overcorrected position. The degree of the deformity and the resistance met in overcoming it, should determine the method to be followed. Cases which, from the beginning, show a marked improvement from manipulation and simple bandaging may be thus treated as long as improvement continues. As soon, however, as improvement becomes arrested, greater care must be given to the retention apparatus. The foot must be held at all times in the best possible position; only in this way can progress be made. If the apparatus used is a removable one and if massage and movements at the joints are practiced, care must be exercised to prevent the assuming of the deformed position, even for a moment, while the apparatus is off."[2]

This quotation from *Diseases and Deformities of the Foot* by Dr. John J. Nutt sounds almost identical with the instruction that one who is interested

in orthodontics, from the orthopedic standpoint, would naturally give when speaking of early treatment in cases of distoversion.

The orthodontist of the future must be more concerned with growth and development, and with the study of nutrition which is fundamental to both.

It has been observed that well-nourished tissues respond more readily than when one encounters deformities in the malnourished. But while on this occasion it is not my intention to stress further the subject of nutrition, yet I mention it as being of fundamental importance in all orthopedic procedures.

Myofunctional treatment, which is only another way of saying orthopedic treatment, is easy to comprehend in a general way, but difficult to comprehend in its particular and varied application to a wide variety of dentofacial deformities. First, I am going to describe a few fundamental exercises which are by no means all that you will need to master in the progress of your general treatment. But they will, I hope, suffice on this occasion to lay a foundation on which to build a growing understanding.

We will, therefore, consider the following muscle groups: The pterygoid, internal and external, then the masseter-temporal, the tongue and its associated muscles, the orbicularis oris, and last of all the general tonic exercise which brings into play all of the muscles of the face and neck. These group exercises, therefore, cover in a general way the field of our efforts. But outside and beyond these are others which your growing interest and experience should dictate to you.

You will have to pardon what may seem like a repetition of parts of former papers, as I reread to you what I have said before regarding these muscular groups. I feel it is quite necessary to have this review because of the preparation that it will give you for a more sympathetic understanding of the moving pictures that will be seen later.

We will consider the pterygoid group first. Not because they are more important than the others, but because there are so many cases presented where the exercise of this group can be of benefit even before the application of any apparatus. It is the inherent weakness of this group of muscles that allows so many mandibles to assume a recessive position during various stages of growth, from the very young through the period of transition. It is, therefore, good practice when a tendency toward distoversion is noticed to teach the child the exercise of this group of muscles. I might explain at this point that, of course, it is understood that muscles cannot be exercised entirely independent of the groups contiguous to them, and that the naming of the various exercise groups is done merely as a matter of convenience—only the dominant muscles in any muscular action being designated. It is astonishing that we have been so long in arriving at an appreciation of the functional importance of this group of muscles.

It is true enough that we have realized vaguely that the principal function of this group of muscles is to adjust the mandible in its various functional movements, but we have not appreciated fully enough that it is possible to adjust the mandible in a relatively normal position. In distoclusion, for instance, we have not realized that this group of muscles does not always adjust the mandible to its normal position because of certain interferences

which the muscle has difficulty in overcoming. Under some circumstances this group of muscles may be encouraged to overcome these handicaps unaided by mechanical apparatus, but in the vast majority of cases of this nature simple mechanical measures need to be employed as preliminary treatment, the proper method being, while removing one interference after another, to encourage these muscles to continuous effort in the direction of normal position. Thus, they may be employed in the treatment of distoclusion, either of a bilateral or unilateral nature.

Their natural tendency is to draw away from the interferences, the character of the interference determining the position of the mandible. For example, in a slightly narrowed maxillary arch, where there are interferences on both sides of the arch, the tendency is to allow the mandible to operate in a distal position, or if the main interference happens to be unilateral their pull becomes unequal and the mandible rotates, ofttimes producing a unilateral position of the mandibular arch. For your benefit I might suggest that one of the best ways to realize the function and possibility of these muscles is to study your individual mechanism. Each one within my hearing possesses a complete set of these, living orthodontic appliances; it is possible for each one to learn much by the careful study of his own possessions. Perhaps no feature of this method of treatment has been more thoroughly misunderstood and misapplied than the exercise of this function when attempting to treat various forms of malocclusion by this method. I always entertain a little hesitancy in trying to illustrate or direct specific exercises, believing that the more proficient method is to lead men to understand the fundamental ideas relative to this form of rational orthodontics, because when the fundamentals are once understood the particular and special methods of operation gradually develop as a consequence.

The pterygoid exercise consists in the simple act of placing the mandibular incisors anterior to the maxillary incisors if the maxillary incisors are in their normal position. In the individual case in which the maxillary incisors are much protruded, no attempt is made to place the mandibular incisors anterior to the maxillary incisors, but advanced only to the mesial limits of the normal excursional area. The patient is then instructed to relax the pterygoid muscle and allow the mandible to recede to the point where the arches are in their relatively correct mesodistal relation. It is important that a correct conception of this simple exercise be borne in mind at all times.

The continued performance of this exercise gradually develops the physiologic habit relative to the mandibular position entirely within the normal rotational function of the mandible. This exercise may be considered as a setting-up drill, resulting in the necessary added tonicity and control. I should like to point out that its performance, during that period of mechanical preparation in correcting the arch form, greatly enhances the patient's ability to maintain the correct mesiodistal relation without strain when the time arrives for the use of the inclined plane apparatus. During its performance in distoclusion cases, the head of the condyle is drawn down on the distal surface of the eminentia articularis and may be held in that position for the duration of the exercise. This preliminary exercise is carried on during the period which is utilized in

the mechanical effort to bring about the necessary change in form of the maxillary and mandibular arches. The length of time varies according to the extent of movement and the rapidity of the tissue changes necessary for the individual.

When the maxillary arch has reached its correct arch form and the arches are placed in their normal mesiodistal relation, an infraversion of the molars and premolars may frequently be observed. In this type of case the patient must be provided with an apparatus which will insure the maintenance of the position of mechanical advantage. This is usually attained by some form of inclined plane either attached to the anterior teeth which are in normal relationship, or a neatly constructed removable apparatus, such as the Hawley retainer with a carefully designed inclined plane. When this stage of treatment has been reached, the patient is ready for instruction in the exercises which are designed to strengthen all the muscles of mastication and which will gradually bring about important physiologic changes which, when established, insure the permanent and satisfactory correction. This exercise and its corrective tendency is purely an orthopedic procedure.

It has been already suggested that we think of our living orthodontic appliances somewhat in similar terms as we do when we consider our mechanical apparatus. That is, each form of appliance is expected when under intelligent direction to produce certain changes in form. The important masseter-temporal group is a living orthodontic appliance of great efficiency and its function in this role is not only developmental in character but also retentive. With the use of this group, under the proper circumstances and under skillful direction, it is possible to develop either the maxillary or mandibular arch, and it is possible with the use of this orthodontic appliance, accompanied by a simple mechanism as an adjunct, to assist in the correction of infraclusion occurring either in the anterior or distal portions of the dental arches. With this orthodontic appliance it is also possible to correct distoclusion, and furthermore, to act as a retentive measure preventing the recurrence of distoclusion.

As a by-product in orthodontic treatment of this nature we find that there is produced a quality which is almost always lacking when treatment is undertaken purely by mechanical means, namely, the full efficiency of the function of mastication. I have been repeatedly reminded by parents, nurses, and physicians that the ability to masticate food has become greatly enhanced, much to the benefit of the individual's health, where greater consumption and assimilation of food has been fundamental in the treatment of the individual.

The masseter-temporal exercise, which, of course, in its performance includes other groups such as the internal pterygoid group of muscles, is valuable during some phase of the treatment of all forms of malocclusion and is especially valuable as a retentive measure, ofttimes entirely dispensing with the mechanical retention of the maxillary arch. This exercise consists in the contraction and relaxation of the masseter group of muscles with the mandible held in a static position and in the position of mechanical advantage created by the use of the inclined plane apparatus. This exercise should never be permitted unless the patient is able to place the mandible in its correct position. The child should be instructed when learning this exercise to place the tip of the

forefinger over the masseter muscle near the angle of the mandible to enable him to sense the contracting and relaxing movements.

Perhaps the group next in importance will be found in the tongue and its attached muscles. No orthodontist of experience is ignorant of this member's ability to bring about serious malocclusions when its habitual use departs from the normal. It was the recognition of certain occlusal defects brought about by the maluse of the tongue that prompted me to ask whether the reverse might not also be true. A few experiments soon revealed the fact that the tongue could indeed be considered an orthodontic appliance of real value, and gradually in my own experience it was found to lend itself quite readily to various forms of treatment. On other occasions I have referred to successful methods of tongue control, particularly in the correction of habit movements which seriously affected the harmony between the dental arches.

As an accompaniment to the masseter-temporal exercise, the tongue exercise is one which has particular virtue, as it also trains the tongue and strengthens those muscles which are particularly influential in the development of the mandibular arch. After the child has learned the masseter-temporal exercise, he is then instructed to place the tip of the tongue against the mucous membrane directly behind the mandibular incisor teeth, and with each contraction of the masseter-temporal group of muscles press the tongue against the anterior section, and, at the same time, by the act of widening the tongue, force it against the lateral sides of the alveolar process. This exercise trains the tongue to remain in its proper position and has a tendency to prevent the narrowing of the mandibular arch, facilitating the earlier removal of retentive appliances.

The next groups of orthodontic appliances which I am going to call to your attention are the ribbon muscles and the orbicularis oris muscle groups. The ribbon muscles of the face and the orbicularis oris blend in such a way that they may be regarded as a unit when considering the improvement in the harmonious development of the face, supplementing the routine treatment undertaken in the correction of various malocclusions. When these groups of muscles have been brought to a tonic condition, through conscious efforts on the part of the patient, they not only improve the general contour of the face, but assist markedly in corrective treatment and retention.

The orbicularis oris exercise is best performed with the aid of an exerciser so designed that it is difficult to keep it within the aperture unless the muscle is properly contracted. During its use, the patient should not allow the instrument to stretch his lips. It must not be overlooked that the orbicularis oris muscle is composed mainly of two sets of fibers, not to consider the fibers of the muscles which intersect. In making the efforts with the exerciser, this should be kept in mind, and these fibers held in as nearly normal relation as possible. If the patient is allowed to curl the lips during the exercise, the effect on the orbicularis oris muscle is not so favorable, but if the fibers are kept in the position which they assume in pronouncing the letter 'p,' a more satisfactory development is obtained. This exercise is continued with one elastic during the first week or two, and contractions are increased each day until they reach fifty or sixty. When the muscle grows in strength, an increase in the number of elastic bands may be made. It is rarely necessary to employ more than two

elastics. The child is taught to control the extent of action of the rubber bands. It is not wise to overload the muscle, because as is well known, any muscle trying to lift a weight must be well within its capacity, increased contractions making up for the lighter task.

The next exercise, which is termed the general tonic exercise, is one which seems to have far-reaching effects. It is not only an exercise which promotes a more copious blood flow to the tissues surrounding the teeth, but also it is valuable in training all the muscles of the face in which we are particularly interested. One need only to give it a few days' faithful personal trial in order to be convinced of its value as a muscular tonic, and also as an exercise of great prophylactic value. It consists in taking a copious sup of warm water in which has been dissolved a portion of either bicarbonate of soda or salt, and with the teeth held firmly in occlusion the water is forced through the interproximal spaces into the buccal cavity, then back into the lingual space. This action is continued until the muscles show slight fatigue. This exercise should be repeated five or six times morning and night. From an orthodontic standpoint it is highly beneficial not only as a tonic, but the alkaline liquid is forced around and through the appliances, no matter how complicated they may be. I like to have my patients continue this exercise after the cessation of all treatment.

It is my purpose now to show you a few examples of simple distoclusion corrected in their early stages by nothing more than the stimulation of functional activity of certain groups of masticatory muscles. There will follow a few slides showing the developmental influence of the masseter-temporal group in stimulating arch development, and then one or two illustrating corrected cases of infraversion of the anterior teeth. Then I am going to try to show certain structural changes in the region of the temporomandibular articulation which followed the treatment of distoversion through orthopedic measures.

Following these you will see various exercises illustrated by the patients themselves, each having benefited materially through faithful application. As the picture unrolls I shall make a few comments calling your attention to features of special interest, especially in relation to orthopedic changes in facial posture.

REFERENCES

1. Milch, Henry: Principles of Orthopedics Practiced in Relation to Orthodontics.
2. Nutt, John H.: Diseases and Deformities of the Foot.

60 CHARLESGATE, WEST

THE MAINTENANCE OF ENAMEL INTEGRITY DURING ORTHODONTIC TREATMENT

HAROLD K. BOX, D.D.S., PH.D., TORONTO, CAN.

THE orthodontist must, of necessity, have a special interest in the subject of oral hygiene, using that term in the broadest sense, viz., the science that deals with the preservation of the health of the mouth. This special interest, in part, lies in the fact that frequently the orthodontist creates a new set of local conditions and establishes for a time a changed environment for such tissues as the enamel, gingivae, and periodontal membrane. Also, the orthodontist carries out his work at a period in the life of the patient when there is a greater tendency to the development of dental caries. It is hoped, therefore, that a broad discussion of the subject of caries, from the viewpoint of the essayist, will not only be of interest but of value as well. It is felt that in many ways the following concept helps to explain the numerous and varied phenomena to be observed in the clinical picture of dental caries. It will be necessary, therefore, at the outset to outline briefly some of the principles involved in this theory of the etiology of this disease.

Every dentist, no doubt, has made the observation, following cleansing procedures on the clinical crown, that the enamel surface under the great majority of adhering plaques is free from the caries process. The removal of other plaques and debris, however, shows enamel that is plainly undergoing the decalcification of early caries. In consequence it is manifest that there are two kinds of plaque material, one which is caries-producing, and one which is not.

Based on these common observations, the writer has stated in an earlier paper[1] that, "it seems logical, therefore, to deduce that plaques having the capacity of initiating caries differ from noncaries plaques in some fundamental manner. They must contain material inherently able to form sugar. They must of necessity remain in contact with the enamel surface for a sufficient time to allow the bacteria to form acid and to permit, by protection from the saliva, its formation with sufficient intensity to thoroughly decalcify the underlying enamel."

This seemed a reasonable basis upon which to build a working hypothesis, although, at the same time, it was realized that some forms of debris on the tooth surface might absorb sugar from the saliva and constitute, under favorable conditions, a medium for the colonization of acid-forming bacteria.

It was known that starch can be separated into two fractions differing greatly in their physical properties. These are known as amylose and amylopectin. Both of these fractions yield maltose sugar on hydrolysis, with dextrins formed as intermediate products. Amylose is readily soluble in water while amylopectin is dissolved with difficulty. Starch when heated in

Read before the Fourteenth Annual Meeting of the Great Lakes Society of Orthodontists, October, 1940, Toronto, Ont.

Published simultaneously in the *Journal of the Canadian Dental Association*.

water above a certain temperature swells to form a viscous opalescent paste. This attribute is commonly ascribed to the amylopectin. Because of its sticky nature and its capacity for sugar formation amylopectin, therefore, seemed to furnish, under suitable conditions, the necessary qualifications for the primary phase in the establishment of caries-producing plaques. The hulls of the starch grains also yield, in the cooking of starches and under oral conditions, a gelatinous substance which forms a tenacious binding material. Its retention on the tooth surfaces may also play a prominent part in the creation of plaque material that is capable of furnishing sugar (Fig. 1).

According to certain investigations, amylose and amylopectin differ chemically in relation to the phosphorus content. The work of other investigators, however, reveals no chemical difference in this regard. Starch in solution exists as aggregates or micelles formed by the association of varying numbers of its simple macromolecules.[2] The less soluble fraction, amylopectin, is thought to be in a highly aggregated state, while the readily soluble fraction, amylose, exists in a form in which the macromolecules are more dispersed. On this basis, the differences in viscosity and solubility of these fractions are explained.

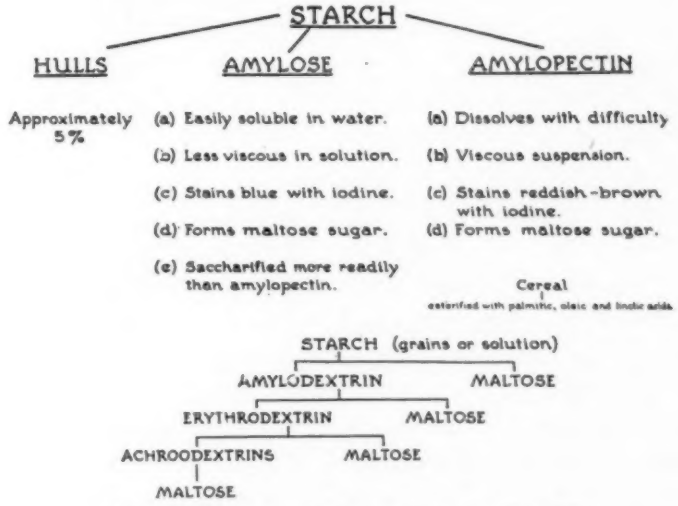


Fig. 1.—Chart showing the fractions of starch.

Ptyalin is commonly understood to be a salivary enzyme capable of splitting starch and converting it into the sugar maltose. More recently the term "salivary amylase" has tended to replace the older term. This amylase is described as being chiefly of the dextrinogenic type, that is to say, it induces the initial stage of starch degradation with reducing dextrins as the predominating products. This is marked by the destruction of the iodine coloring property. The secondary stage of hydrolysis by saliva is carried out with great rapidity, maltose being the main end product.

It is significant to note that in starch paste degradation, with human salivary amylase, the visible liquefying activity was found to be more resistant to heat than the saccharifying phase. It was found in our laboratory that when pure saliva had been heated to 75° C. for sixty seconds, rapid liquefaction of starch hulls took place at 37° C., but the blue coloration with iodine was not destroyed.

That is to say, the dextrinogenic action was destroyed. Both of these activities can be brought to a standstill by heating the saliva in a water bath for ten minutes at 70° C. But when heated to 65° C. for the same length of time, both the liquefying and dextrinogenic properties were found to be present. These findings were taken to indicate that human salivary amylase embraced both liquefying and dextrinogenic components.

It has long been known that amylose and amylopectin are not converted into sugar at the same rate. The amylose undergoes a rapid change while the conversion of amylopectin proceeds at a much slower rate.

Haldane[3] has pointed out that when any amylase acts on starch, a dextrin remains which arises solely from the amylopectin. This residual material, if broken down at all, is destroyed very slowly. Its digestion into maltose, however, is made possible when certain substances are added. It seems apparent, therefore, that any interference with liquefaction of amylopectin and starch hulls would tend toward the retention of carbohydrate debris on the tooth surface. This is commonly understood to be related, under favorable conditions, to the colonization of acid-forming bacteria and the localization of dental caries. In other words, under strong enzyme activity there is rapid liquefaction with sugar formation and reduced retention of debris. With weak enzyme activity, the liquefaction is slow, with prolonged sugar formation. With the initiation of the caries process, the local factors become dominant in the retention of carbohydrate debris.

It will be pertinent, then, at this time to outline certain factors which tend to interfere with the effective removal of starch residues from the tooth surface.

1. *Saliva Poor in Liquefying Amylase.*—It is recognized that in general the velocity of reaction is proportional to the concentration of the enzyme.

In all probability, according to Maximow and Bloom,[4] the albuminous cells in the salivary glands are the source of the amylase. It is known that chronic inflammation of the salivary glands may be responsible for partial destruction of the parenchymatous tissue. According to Moorehead and Dewey,[5] this chronic inflammatory process may take place as a complication of chronic intoxications from bismuth, mercury and lead, or disturbances of metabolism. It is possible, also, that low-grade infections of the glands by bacterial invasion from the mouth through the salivary ducts are more common than has hitherto been suspected. Over forty years ago Harris[6] demonstrated by histologic studies the chronic fibroid changes in the salivary glands in these inflammations. It is obvious that marked destruction of the secretory cells of a salivary gland must have a bearing on the amylase output. This whole problem is an important one, and further investigation is greatly needed (Figs. 2 and 3).

2. *A Reduced Volume of Saliva.*—This makes for reduced conditions of hydration and, in consequence, impairs the enzymatic action. According to the studies on salivary secretion made by Dickinson,[7] it was shown that frequently the salivary output was materially below the normal. The etiology of marked suppression of salivary flow is by no means clear. It has been pointed out by Endelman and Wagner[8] that "people with scanty saliva, almost dry mouths,

and dry mouths are more susceptible to the ravages of caries," and they also state that this is probably due to the retention of sticky starchy deposits on the tooth surfaces in these conditions.

Fig. 2.—Section from right parotid salivary gland. *a,a*, Normal lobules. *b*, Thickened trabeculae. *c*, Cellular infiltration into a lobule. *d*, A duct the wall of which is thickened and infiltrated with cells, and the lumen decreased in size. *e*, An artery with cellular infiltration into its walls. (From Coplin's *Manual of Pathology*, P. Blakiston's Son & Co., Philadelphia. Case reported by H. E. Harris, M.D., in the *Boston Medical and Surgical Journal*, May 18, 1899.)

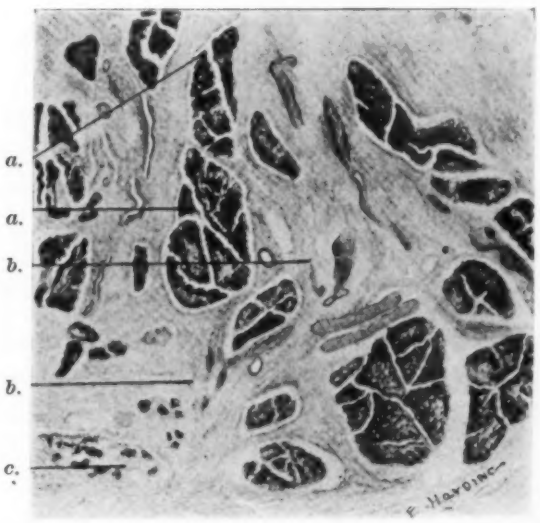


Fig. 3.—Section of the left parotid salivary gland. *a,a*, Normal lobules. *b,b*, Greatly thickened trabeculae. *c*, Lobule almost entirely changed to fibrous tissue. (From Coplin's *Manual of Pathology*, P. Blakiston's Son & Co., Philadelphia. Case reported by H. E. Harris, M.D., in the *Boston Medical and Surgical Journal*, May 18, 1899.)

3. *Absence or Lack of Necessary Activators or Complements.*—The chlorides and phosphates are involved here.

4. *Presence of Inhibiting Substances* (e.g., acids, alkalis, sugars, soaps, and the salts of metals, such as silver and mercury).—It is of considerable interest to note that in 1910, Clarence Grieves,[9] following his investigations on base metal versus noble metal appliances in orthodontics, reported that from the wasting

of German silver in the mouth, the saliva was profoundly modified. He felt sure that the metallic waste interfered with the enzyme ptyalin.

5. *The Physical Character of Carbohydrate Food.*—Rosebury[10] showed, in his carefully executed experiments on dental caries produced by pilot biscuit in rats, the relationship between hardness of the food and particle size. Both fissure and proximogingival caries were produced in the highest incidence when the hardest type of pilot biscuit was used. The soft biscuit caused no caries of either type. Coarsely ground biscuit produced more fissure caries than the finely ground, but on the other hand, proximogingival caries occurred in the greatest amount when the biscuit was finely ground. When coarsely ground corn was used, fissure caries was produced, and in a higher incidence than when pilot biscuit was used. With coarsely ground corn, however, much less proximogingival caries occurred.

From these valuable findings, it would seem that in the case of pilot biscuit, the hardness of the food was related to the problem of hydration and thus directly with the rate of liquefaction. The saliva of rodents is amylolytic, and its action on the starch is obviously favored when the food is soft and easily moistened. The hard food is thus more resistant to the action of the amylases and its retention thereby facilitated. The particle size is apparently related to the mechanical problem of lodgment, the large particles tending to pack firmly in the fissures, the small ones being more suitable for interproximal accumulation.

In the case of ground corn it must be pointed out that when it is uncooked, it is resistant to the action of salivary amylase. Finely ground corn, in contrast to the coarsely ground, is more effective in relation to the presence of a protective factor, viz., corn oil. When the corn is finely ground, the oily constituent is more dispersed throughout the material. Rosebury and Karshan showed that the addition of corn oil to a caries-producing basal diet caused a marked reduction in dental caries in rats.

The foregoing five factors are concerned directly with the rate of removal and, therefore, with the retention of carbohydrate debris on the tooth surface. They are related to the creation of an ideal environment for the colonization of acid-forming bacteria and the localization of acid production on the tooth surface.

It will be of interest to learn that in the liquefaction of the tooth-borne amylopectin, the removal of this sugar-forming material is by no means the only benefit obtained in the process. As early as 1926, Taylor and Lehrmann[11] noted the presence of small quantities of fatty acids in maize starch. These were regarded as organically combined with the amylopectin. More recently Ruhland and Wolf[12] have pointed out that in the seeds of cereals, the amylopectin is esterified with the following fatty acids, viz., palmitic, oleic, and linolic. Taylor and Sherman[13] were able to split up this ester by the action of lipase-free amylase, as well as by acids and bases. According to their findings the fatty acid content of whole corn starch was 0.73 per cent. The amylopectin fraction yielded approximately 4 per cent of fatty acids.

In our laboratory investigations it was found that salivary amylase was effective in liberating fatty acids from starch paste. And with specially made smears taken from clean enamel surfaces in the mouths of patients, fatty acid material has been repeatedly demonstrated by special staining methods.

We now propose to demonstrate briefly our reasons for stating that the production of fatty acid films on the tooth surface constitutes a second benefit in the liquefaction process, namely, protection of the surface against acid attack.

In the first place, when a tooth was suspended in a fermenting bread or starch mixture, incubated at 37° C. for three or four days, with the pH about 4.5, it showed definite evidence of decalcification of the enamel surface.[14] When a small amount of amylase-active saliva was added to a similar bread mixture, and incubated under approximately the same conditions of time, temperature, and hydrogen-ion concentration, no evidence of decalcification of enamel was found. It was evident, therefore, that in the second case some protective factor was operative which was absent in the first experiment.

It was known from previous experiments conducted in our laboratory that teeth suspended in acid solutions, e.g., dilute HCl, and buffered solutions, pH 5.0, which readily produced decalcification, were protected from the action of the acid solutions upon the addition of a small amount of sodium oleate. As the soaps of the higher fatty acids cannot exist in solutions under pH 9.0,[15] it is evident that under the above conditions, the sodium oleate dissociated into oleic acid. This was subsequently shown to be the case with certain staining methods, and further it was found that oleic acid, applied to the tooth surface, afforded the same measure of protection that was demonstrated in the case of sodium oleate.

A discussion of the stability of fatty acid films on the tooth surfaces in the two divisions of the human oral cavity, the vestibule and the oral cavity proper, is beyond the scope of the present paper.

SUGGESTIONS AS TO PROPHYLAXIS AND THERAPY

The general regions on tooth surfaces where caries is initiated are three in number: in pits and fissures, on proximal surfaces under the contact point, and on labial and buccal surfaces near the gingival line. When the patient is susceptible to caries, the regions prone to attack on the labial and buccal surfaces are clearly the portions unscoured by the passage of food. In the immune patient caries does not begin in these regions, in spite of the presence of adhesive debris. It would appear, on the other hand, that this deposit may actually exert a protective influence against the caries process. In the case of labial and buccal orthodontic appliances, the lack of scouring of the cervical regions is accentuated and in susceptible patients may thus favor the inception of the caries process, and also its extent.

In the case of proximal caries, there is also manifested a relationship between the area of poorly scoured surface and the liability to caries. When the embrasure is filled with proximal gingival tissue, there is obviously less tendency to food lodgment. It is important, therefore, that in the placing of bands on

teeth, the procedure should not involve the blunting of the gingival margin, with consequent formation of a space.

It is significant to note that thirty years ago Clarence Grieves[16] pointed out that careful and regular cleansing of the tooth surfaces in children undergoing orthodontic treatment made these surfaces about the appliances more liable to decalcification. He stated, "This would seem to indicate the loss of something; that some protective process had been interfered with." In the light of our present findings, it is tempting to suggest that this protective agency is related to the presence of the fatty acid film.

In the prophylaxis of cervical caries, the orthodontist should pay particular attention to the oral vestibule, that division of the oral cavity specially prone to the inception of this form of the disease. To this end, his main concern should be the speedy rendering of sticky carbohydrate plaques and debris into readily soluble material, and the establishment of protective substances on the susceptible tooth surfaces.

The essayist suggests the use of two combinations in the attainment of these desirable results. The first is a product known as Enzodent (Squibb) and is a powder rich in enzymes, particularly amylases, and contains activators. It is specially buffered for use in the human mouth.

According to laboratory tests, among its properties are the following: (1) It liquefies the amylopectin and hulls of starch. (2) It sets free fatty acids from the amylopectin. These qualities would seem eminently to endow it for the task of rapid removal of starch residues from the susceptible surfaces of the teeth and the establishment of a protective fatty acid coating in these regions.

Where additional protection of the tooth surface against acid attack is indicated, as for example, in enamel surface defects such as chemico-abrasion, and in extreme cases of susceptibility to dental caries, the following protective solution is recommended.

℞ Sodium oleate (neutral)		ʒ iss
Glycerine		ʒ iv
Rectified spirit		ʒ vi
Hot water		ʒ vi
Oil of peppermint		M xx
Oil of wintergreen		M xx
Oil of cloves		M x
Ess. vanilla		ʒ ss
Sol carmine	q.s.	

M.

Sig: 10 to 15 drops on a wet brush to be used as a dentifrice as directed.

This solution is detergent and is adsorbed on the tooth surface as a film of sodium oleate. This apparently undergoes dissociation in the human saliva, leaving on the tooth an extremely thin coating of oleic acid. In the case of children showing a marked susceptibility to dental caries, it is recommended to be used following the use of Enzodent. In the case of adults manifesting tooth wasting, such as chemico-abrasion,* it is used as a dentifrice on retiring.

*During the discussion Dr. Box pointed out that in the production of chemico-abrasion, in all probability, three factors are involved. These are as follows:

1. Removal of a protective substance from the tooth surface; 2. decalcification of the superficial enamel; and 3. abrasion which keeps pace with the decalcification factor; with the establishment of the characteristic smooth and polished surface. Chemico-abrasion mainly affects the labial and buccal surfaces of the teeth and appears to attack the maxillary teeth more frequently than the mandibular. Where cases in practice present chemico-abrasion in the oral vestibule with no supragingival calculus in the oral cavity proper, only the protective sodium oleate solution is recommended. It is understood, of course, that the patient should be instructed in a suitable method of brushing.

Where patients present no chemico-abrasion in the vestibule with supragingival calculus prone to form in the oral cavity proper, the use of Enzodent is recommended. Enzodent is also prescribed for cases of moderate susceptibility to caries, and where marked susceptibility is manifested, its use is followed by the sodium oleate solution.

REFERENCES

1. Box: A Liquefying Amylase in Human Saliva, Amylopectin, and Dental Caries, Bulletin 24, Canadian Dental Research Foundation, December, 1938.
2. Hanes: The Action of Amylases in Relation to the Structure of Starch and Its Metabolism in the Plant, The New Phytologist, April, 1937.
3. Haldane: Enzymes, 1930, Longmans, Green and Co.
4. Maximow and Bloom: Text-book of Histology, 1931, W. B. Saunders Co.
5. Moorehead and Dewey: Pathology of the Mouth, 1925, W. B. Saunders Co.
6. Harris: Boston Medical and Surgical Journal, May, 1899.
7. Coplin: Manual of Pathology, 1900, P. Blakiston's Son and Co.
8. Endelman and Wagner: General and Dental Pathology, 1920, The C. V. Mosby Co.
9. Grieves: Report of Work on "Base versus Noble Metals in the Mouth," Dent. Items Interest, February, 1910.
10. Rosebury: Dental Caries in Rats Produced by Hard Pilot Biscuit, J. Dent. Res., August, 1939.
11. Taylor and Lehrmann: J. Am. Chem. Soc. **48**: 1739, 1926.
12. Ruhland and Wolf: Metabolism of Carbohydrates and Organic Acids in Plants, Ann. Rev. Biochem. 1936.
13. Taylor and Sherman: Carbohydrate-Fatty Acid Linkings in Corn Alpha Amylose, J. Am. Chem. Soc. **55**: 258, 1933.
14. Box: Twelve Periodontal Studies, The University of Toronto Press, 1940.
15. Hawk and Bergeim: Practical Physiological Chemistry, Ed. 11, 1937, P. Blakiston's Son and Company, Inc.
16. Grieves: Report of Work on "Base versus Noble Metals in the Mouth," Dent. Items Interest, February, 1910.

86 Bloor Street, West

MEDICO-DENTAL PROBLEMS

Particularly Those Related to Certain Deficiencies

William V. Watson, M.B., Toronto, Can.

THE physician frequently finds his patients have dental manifestations related to or accompanying their general problem. The dentist, particularly the orthodontist, is in an advantageous position. He sees defects in growth and in mineralization early.

There is little new in what follows, still, some facts must be reviewed.

As to calcium,[1] the adult daily need is 0.63 Gm. (as calcium oxide). The average normal content of calcium in blood is 10 mg., per 100 c.c., of which approximately one-half is bound to protein and, therefore, not diffusible; the remaining diffusible is ionic. Recent work has shown that in the presence of citrates or lactose a soluble nonionized calcium is available.

The balance in this form is maintained by a group of factors, among which are the parathyroids, vitamin D, the amount of blood protein, acid base equilibrium, and the amount of blood phosphorus.

Absorption is dependent upon factors, among which are substances in the diet other than calcium. Excessive fats and markedly increased hydrogen-ion concentration within the intestine impede absorption. Excessive phosphates are another factor, as tertiary calcium phosphate is not absorbed. Calcium oxalate seems to be responsible for some loss. Many leafy vegetables contain oxalic acid.[2] On the other hand, lactose in fairly large amounts promotes the absorption of calcium.

Bone contains 65 per cent calcium by weight. The excretion of calcium is 70 per cent in feces and 30 per cent in urine.

In conditions of hypersensitiveness, allergic states, calcium is poorly absorbed since here there is generally an increased alkalinity in the intestinal tract. The physician frequently finds that the allergic individual is not only a problem in hypersensitiveness but is also very susceptible to infection and is poorly mineralized.

While there may be a normal total calcium in the blood, only the ionic and certain soluble forms are available.[3] It is important that the available calcium be sufficient. An interesting editorial comment on ionized calcium in milk appeared in the *J. A. M. A.*, Aug. 17, 1940, in which the relation of lactose to the absorption of calcium was stressed.

Calcium should be given before meals so that it may be present during the time of increased acidity.

The best form of calcium in the food is in milk and cheese. In vegetables the relatively small amount present is lost in the water in which they are cooked. Some methods of preparation avoid this loss.

Read before the Fourteenth Annual Meeting of the Great Lakes Society of Orthodontists, October, 1940, Toronto, Ont.

Dr. Francis Pottenger, Jr.,[4, 5] in some work still in progress, finds that cats on a diet deficient in calcium produce litters with marked skeletal changes. The heads develop wedge shaped, losing the characteristic appearance of the healthy cat. Accompanying these skeletal changes there is an early appearance of gangrenous gingivitis with loss of some teeth. In subsequent generations from these cats the defect becomes more marked until the animals fail to reproduce.

While sufficient calcium should be present in the diet, the individual's ability to absorb and utilize it is quite as essential. There remains much to be learned of what actually takes place in the utilization of calcium.

Phosphorus is essential. The best foods to provide phosphorus are meats and milk. There is little else of value for this purpose.

The intriguing problem of hormone deficiencies requires some remarks regarding at least one, the thyroid.

The whole thyroid problem has been reopened by many workers in the endocrine field. The active substances of the thyroid hormone, thyroxin, are tyrosine and iodine.[6] Iodine normally combines with tyrosine in the intestinal tract. Intestinal disturbances, bacterial in origin, may convert tyrosine to tyramine through the action of carboxylase. Experimentally, dogs absorb tyramine easily from the intestinal tract. The absorption of tyrosine from the intestine is, therefore, important in maintaining a normal balance of thyroxin. McCarrison, as early as 1921 in an address in Toronto, drew attention to the possibility of thyroid dysfunction being associated with intestinal disturbance.[7]

Marked hypothyroidism carries a classical symptomatology. Borderline types and early involvement are not as simple, requiring careful history, investigation, and observation.

The basal metabolic rate is an estimation of the amount of energy being used by the patient at rest, that is, in a basal state. The thyroid activity when the patient is at rest is only one factor that is so measured.

The relation of thyroid to growth has been well presented by Todd[8] which he illustrated so well with the skulls of thyroidectomized sheep.

A group of chemical substances capable of active oxidation-reduction reactions, have been called vitamins. These have a stimulating effect on cellular growth, and another function which is related to the hormones. One relationship has certainly been established, that is, the case of vitamin E and ovarian function. One can easily see why there have been so many functions attributed to the vitamins.

The autonomic nervous system must be considered in evaluating the deficiencies of any patient. There must be a physiologic balance between the sympathetic and the parasympathetic.

Since the circulatory system distributes nourishment to the tissues through the capillaries, we make sure there is sufficient blood supply in these minute vessels.

Anemia, apart from that due to hemorrhage, is generally a symptom of a deficiency disease. Efforts for its correction are directed toward the causative deficiencies.

Levy, in a recent paper in the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY, July, 1940, has expressed a truth by quoting from Socrates. In

summary he suggests that when there is pathology in the teeth or surrounding tissues, this is only a part of a complex present in other parts of the body.

The following cases illustrate the relation between the mouth and some of the deficiencies. All irrelevant details of histories are omitted.

CASE 1.—Miss U. H., aged 17 years, was sent as a problem in caries, there being twenty-seven cavities. She had always been a dental problem. She had had influenzal pneumonia at 5 years, and this was followed by an otitis media. Orthodontic work had been done in Europe where she was a resident in school.

There was a red blood count of 4.18 million and hemoglobin 86 per cent. Measurement of the size of the red cells was macrocytic. The nail-fold capillaries could be seen in about one quarter the normal number. A Peck test for capillary fragility was positive, and a measure of ascorbic acid in the tissues was low.

Menses appeared at 15 years. Examination of chest and abdomen showed no abnormality.

Treatment included a balanced diet, liver extract, and ascorbic acid.

Comment.—Several months have elapsed with no further caries. It was suggested by her dentist that it was possible that she did not adjust herself easily to the diet away from home and, therefore, used only foods that were chiefly carbohydrate.

CASE 2.—J. E. was aged 16 years 7 months. Her orthodontist found that he could not complete his work satisfactorily because of deficient mineralization.

There had been measles at 4 years and mumps at 6 years. While her brother grew normally, she exhibited no typical growth spurts. She had marked caries.

Some of her findings are of sufficient interest to report in detail.

Blood Counts:	June	July	Sept.
Red blood count	4.57	5.1	4.82
Hemoglobin	76%	76%	96%
White blood count	4,200	4,800	8,900
Differential white blood count	normal	normal	–
Platelets	normal	–	–
Blood Sugar	114 mg. %		
Calcium	9.4		
Phosphorus	4.1		
Cholesterol	138		
Basal Metabolic Rate	minus 22%		

Urine: Reaction hydrogen-ion concentration 7.2
Sugar—a faint trace
Microscopic—A few bacteria, otherwise normal.

Her treatment was as follows: Calcium gluconate, iron, carotene, and sufficient milk included in her diet. The urinary infection was cleared up.

Comment.—If ascorbic acid had been available at the time of this patient's observation, it would have been added to advantage. Where there is a low blood cholesterol and a low basal metabolic rate, thyroid medication is not always necessary to attain a result.

The clinical result was satisfactory because the patient received enough calcium; her anemia was adequately corrected; and the urinary infection was eliminated. The leucopenia was finally replaced by a normal white cell count.

No change was noted in the position of the teeth following removal of the retaining appliance.

CASE 3.—Mr. R. J. N. was 30 years of age. For ten years he had been losing weight while eating sufficient food. He noted that he suffered extreme fatigue and was afraid he had tuberculosis. He had constantly recurring colds, nasal polypi, and the antrum had been drained. The only factor in the family history that was relative was that his mother had had a macrocytic anemia.

He was found to have a lowered basal metabolic rate and insufficient blood phosphorus. Since his blood cholesterol was high he was given only very small doses of thyroxin and glycerophosphates until the blood phosphorus was normal. Thyroxin was increased, and his improvement was so definite that little else seemed necessary since his fatigue and frequent respiratory infections had ceased.

However, on seeing his dentist he got a report that there was some osteoporosis and a little later acquired a pharyngitis. He was given 150 mg. ascorbic acid daily, to be reduced in a few days to 50 mg. daily. The thyroxin had been increased to what was found to be his maintenance dose of 1 mg. daily.

Comment.—Of particular importance is the family history. The patient's mother had suffered an anemia since childhood.

Improvement in this patient's condition has been striking. He did not suffer from osteoporosis. He had no pain in weight-bearing joints and no x-ray evidence. There was some resorption of the alveolar process.

This patient's dental problems, along with his other abnormalities, will be less difficult in the future since any increased functional demand is now well met.

CASE 4.—S. B., aged 10 years 11 months, was referred after being checked for cause of a chronic cough. Tuberculosis was carefully ruled out. Marked muscular fatigue necessitated her being home from school a year. She slept more than average.

There was a history of frequent colds, eczema, hay fever, and caries. Her findings showed a macrocytic hypochromic anemia which had existed over several years. Very few capillaries were seen. Only slight capillary fragility.

Saliva counts were done by Dr. Philip Jay. However, too many other factors existed to allow the limitation of carbohydrate to be of value; still, it remains reduced.

Immediate increase in number of visible nail-fold capillaries was accomplished with histamine, and a correction of the anemia was started. Later ascorbic acid was added.

A rather extensive progressive caries is no longer in evidence.

Comment.—Here is illustrated the fact that correcting local pathology must be supported by a normal physiologic background.

CASES 5 and 6.—C. E. and N. E. were aged 5 years 9 months and 7 years 2 months. These sisters suffered colds continuously throughout each winter.

They are presented here as examples in which the correction of this susceptibility to colds should be part of a prophylactic program. Their mouths and teeth are now normal.

Both suffered severe attacks of measles and pertussis.

In determining their bone age, which was found to coincide with their chronologic age, very marked bone scorings were seen in both cases.

All other findings are normal or not applicable.

Comment.—If these acute infections were severe enough to produce such marked scorings, their mouths will require careful dental care until the susceptibility to respiratory infections is past. However, it is to be noted that the relatively small number of cases which have shown marked bone scorings in the radius have not been dental problems.

Case 7.—Mr. D. B., aged 33 years, was a patient with ocular hemorrhage which was controlled over a period of four years. Cataracts appeared in both eyes. The oculist removed the more advanced cataract. Recovery was slow and difficult.

He had been a very difficult patient because of a marked sympatheticotonia in which his approach to all his problems was most intense.

Although he had had frequent dental care, it was felt this may not have been adequate. He had several extractions without improvement. A more complete and efficient examination resulted in further extractions followed by a rapid improvement in the operated eye.

Comment.—An imbalance in this patient's nervous system made the routine course of treatment impossible. His attitude toward proper dental investigation could only be corrected by the impending disaster of the possible loss of vision in his operated eye.

Radical variations from the normal autonomic balance require radical changes in the routine procedure of treatment.

Case 8.—Miss F. S. was aged 49 years. This patient came suffering from an acute sciatica. Her progress was very slow. There was a functional recovery, but it was not a satisfactory one.

Throughout the observation of this case there was always noted a retention of fluid in all the tissues.

The following findings may be of interest: The red blood count was constantly reduced, and platelets were constantly reduced. The Peck test was positive. The skin ascorbic acid was much reduced. Few nail-fold capillaries were seen. The basal metabolic rate was lowered. There was excessive uterine bleeding.

Besides the treatment of the sciatica she received ascorbic acid.

The edematous condition of her gums proved to be a splendid index of the effect of treatment, as improvement occurred in direct response to ascorbic acid, the larger the dose the greater the improvement. The edematous gingival tissue returned as soon as the dosage was reduced.

The amounts required to get improvement were 150 mg. daily by mouth, and an additional 500 mg. intravenously, weekly.

Comment.—This demonstrates the value of ascorbic acid where it has been proved to be deficient. A similar benefit was noted in the sciatica.

SUMMARY

Some facts relating to calcium utilization have been reviewed.

The importance of protein in the production of thyroxin is stressed.

Ascorbic acid deficiencies have been illustrated in case histories.

The role of the autonomic nervous system, the capillary circulation, and anemia has been pointed out.

Acknowledgment is extended to those of you who have helped in the case problems presented.

REFERENCES

1. Bernheim, A. R.: J. A. M. A. **100**: 1001, 1933.
2. Sherman, H. C.: Chemistry of Food and Nutrition, 1933, p. 278.
3. Nordbo, R.: J. Biol. Chem. **128**: 745, 1939.
4. Pottenger, F. M., Jr., and Simonsen, D. G.: Southern California State Dental Association, November, 1939.
5. Pottenger, F. M., Jr.: Personal Communication, 1940.
6. Hinton, J. William: Tr. Am. Therap. Soc., 1937.
7. McCarrison, R.: Academy of Medicine, Toronto, 1921.
8. Todd, T. Wingate: INT. J. ORTHODONTIA **23**: 791, 1937.

THE INFLUENCE OF MOVING DECIDUOUS TEETH ON THE PERMANENT SUCCESSORS

CARL BREITNER, M.D., NEW YORK, N. Y.

THIS paper deals with the effect that orthodontic treatment of the deciduous and mixed dentition may have upon the developing permanent teeth. A definite knowledge of the tissue reactions which occur during deciduous tooth movement is essential to this problem. Therefore, the important aspect of this presentation is a histologic study of these tissue changes. The results of such study may be of assistance in determining:

First: the age level most desirable for orthodontic treatment,
Second: the type of appliances suitable for treatment of the deciduous dentition.

LITERATURE

Histologic evidence of the influence of deciduous tooth movement on the tooth germs has been published only, to the author's knowledge, in an article by M. Tischler and the author.[1] Related histologic findings were published by Rudolf Kronfeld,[2] Johnson, Appleton, and Rittershofer[3] and Weinmann and Kronfeld.[4]

The question of the age at which corrective orthodontic treatment is most advantageously begun has been widely discussed. Most textbooks of orthodontics include a chapter dealing with this problem. Various opinions have been expressed by Angle,[5] Baker,[6] Hellman,[7] Hopkins,[8] Johnson,[9] Lewis,[10] Lischer,[11] McCoy,[12] Mershon,[13] Northcroft,[14] Strang,[15] Waugh,[16] and others.

METHODS AND MATERIALS

Histologic investigations were conducted on several *Macacus rhesus* and one Java monkey after they had been subjected to experimental orthodontic treatment. The material obtained from the *Macacus rhesus* monkeys originated in part from a series of experiments which were described in the June, 1940, issue of this Journal.[17] A Java monkey with full deciduous dentition was used to complete the investigation, and in this part of the work the author had the cooperation of Dr. M. Tischler.

Fig. 1 shows a tooth germ situated between the roots of a maxillary deciduous molar. One would expect that the tooth germ which is surrounded by deciduous roots must move with them. The histologic evidence of this fact is shown in Figs. 2, 3, and 4. Fig. 2 represents the lingual root of a maxillary deciduous molar. (In a center section no buccal root is visible.) The areas enclosed in

Read before the New York Society of Orthodontists, Nov. 12, 1940.
From the School of Dental and Oral Surgery, Columbia University, New York.

the frames *A* and *B* are shown in higher magnification in Figs. 3 and 4, respectively. In Fig. 3 (frame *A* of Fig. 2) we see, to the right, part of the deciduous root (*D*). The periodontal space (*P*) is narrowed as a sign of pressure, and the periodontal tissue is slightly crushed in one place (*C*). There is an adjoining thin layer of bone which shows giant cells (*G*), a sign of resorption. To the left in the same figure we see part of the tooth follicle. This picture indicates movement of the deciduous root toward the tooth germ. Fig. 4 shows a

Fig. 1.—Buccolingual section through a maxillary deciduous molar. Future permanent premolar lying between the roots.

Fig. 2.—Buccolingual section through a maxillary deciduous molar. (Center section shows only lingual root.) See Figs. 3 and 4 showing frames *A* and *B* in high power.

higher magnification of frame *B* of Fig. 2. To the right we see the enamel matrix (*M*) of the germ lined with ameloblasts (*A*). The bright area represents the stellate reticulum bordered by bone tissue to the left. Giant cells (*G*) indicate that the bud is moving in the same direction as the adjoining deciduous root. The photomicrographs shown above are evidence that a tooth germ enclosed between the roots of a deciduous tooth moves with the roots.

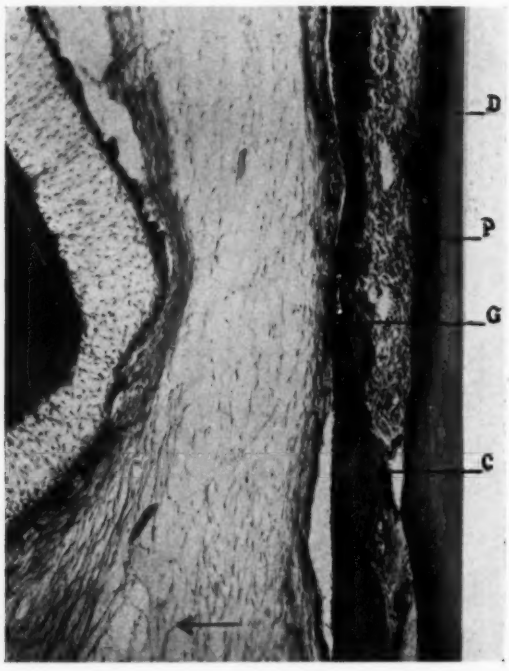


Fig. 3.—Frame *A* of Fig. 2. *D*-deciduous root. *P*-periodontal membrane. *C*-crushing of periodontal membrane. *G*-giant cells.

Fig. 4.—Frame *B* of Fig. 2. *M*-enamel matrix of the germ. *A*-ameloblasts. *G*-giant cells on the bone toward the germ.

Fig. 5 shows a mesiodistal section of a mandible of a young *Macacus rhesus* in which the erupted deciduous molars were moved mesially (arrow). A labial arch, pressing against one central incisor, was ligated to buccal tubes soldered to thin metal caps which were cemented onto the deciduous and first permanent

molars. Again, three framed areas, *A*, *B*, and *C* of Fig. 5, are shown in higher magnification in the following photomicrographs, Figs. 6, 7, and 8.

Fig. 6 (frame *A* of Fig. 5) shows to the left the germ of the permanent second premolar. Part of the distal root of the second deciduous molar (*R*) is visible in the middle of the picture, and the root of the permanent molar can be seen on the rig[illegible]. The roots of the deciduous and the permanent molars are surrounded by bone tissue which shows changes characteristic of tooth move-

Fig. 5.—Mesiodistal section through the mandible. Bodily movement in mesial direction. See also Figs. 6, 7, and 8 showing the framed areas *A*, *B*, and *C* in high power.

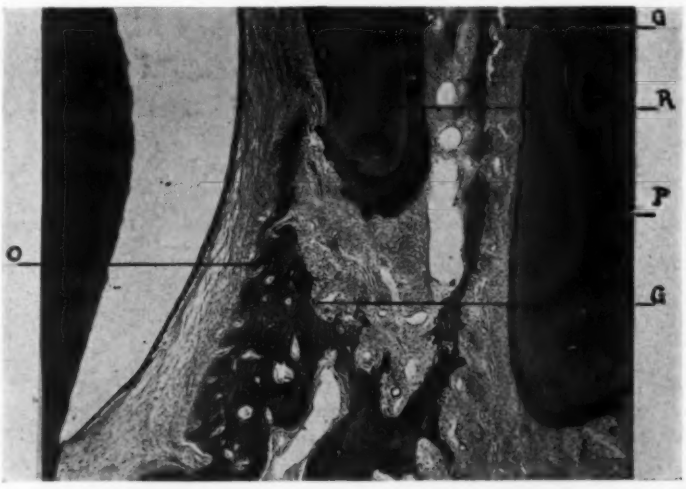


Fig. 6.—Frame *A* of Fig. 5. *R*-deciduous root. *P*-mesial root of first permanent molar. *G*-giant cells. *O*-osteoblastic lining.

ment. There is bone resorption (giant cells) at *G* and deposition of new bone lined with osteoblasts toward the germ and the deciduous root at *O*. This bone deposition and resorption indicate movement of both the germ and the roots in the same direction, namely, to the left in the picture. Since the germ is located in front of the root of the erupted tooth in the direction of its movement (pushed), this influence is easily comprehended.

The following two pictures illustrate the condition of the unerupted second molar which, as will be shown, is also in a state of mesial migration. Fig. 7 (frame *B* of Fig. 5) shows to the left part of the interalveolar septum (*S*) between the erupted first and the unerupted second molars; to the right a portion of the root of the unerupted molar is visible. The connective tissue between

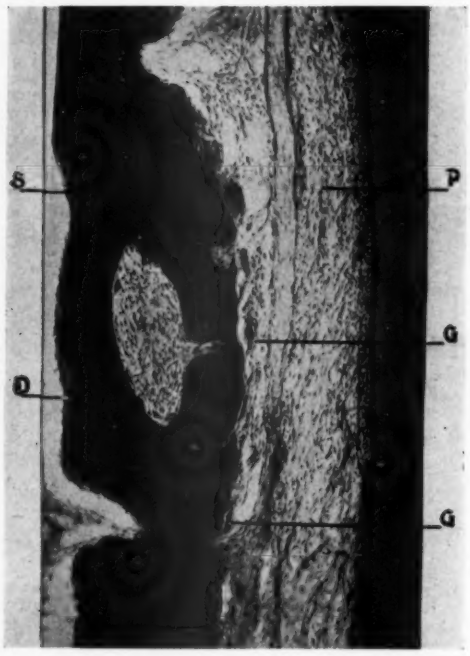


Fig. 7.—Frame *B* of Fig. 5. *S*-interalveolar septum. *O*-osteoblastic lining. *G*-giant cells. *P*-periodontal membrane of unerupted second molar.

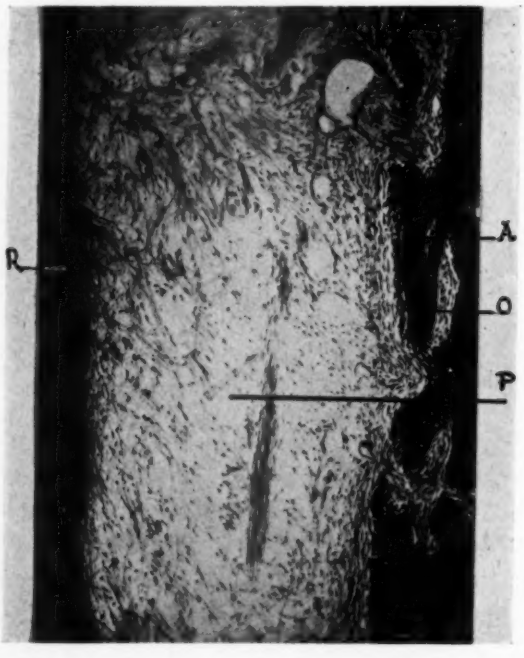


Fig. 8.—Frame *C* of Fig. 5. *R*-root of unerupted second molar. *A*-alveolar bone. O-osteoblastic lining. *P*-periodontal membrane (compare width with same structure on mesial side in Fig. 7). Germ moves mesially.

these two structures represents the periodontal membrane (*P*). Many giant cells (*G*) which are found toward the periodontal membrane indicate active resorption. On the other hand, the bone trabecula visible in the picture to the extreme left shows osteoblastic lining (*O*) toward the marrow. Fig. 8, frame *C* of Fig. 5, shows the root surface (*R*) of the same unerupted second molar to the left, and alveolar bone (*A*) to the right. The periodontal space between these two structures is about twice as wide as in the preceding picture (same magnification). The bone shows osteoblastic lining (*O*) toward the periodontium. Figs. 7 and 8, taken from the mesial and distal side of the follicle, are a definite indication of mesial migration of the germ.

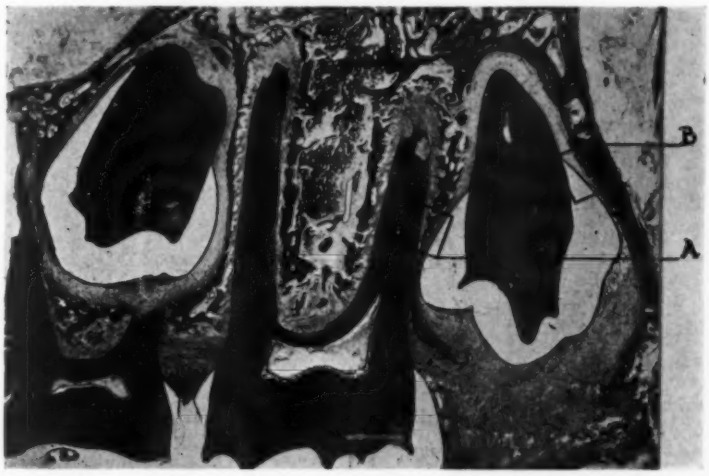


Fig. 9.—Mesiodistal section through the maxilla. Bodily movement. Framed areas *A* and *B* appear in higher magnification in Figs. 10 and 11. Note root resorption in first permanent molar.

The next pictures are taken from the maxilla of the same animal in which the teeth were moved distally instead of mesially. A labial arch fixed on caps cemented to the molars was ligated to a central incisor which thus was pulled labially, while the distal reaction of the force pushed the molars distally. Fig. 9 represents a survey of a second deciduous molar, first permanent molar, and unerupted second molar. Frames *A* and *B* are magnified in Figs. 10 and 11. Fig. 10 shows the root of the permanent first molar (*R*) to the left and the enamel of the unerupted second molar (*E*) to the right. The bony septum between these structures shows signs of resorption (giant cells, *G*) toward the root of the erupted tooth, and osteoblastic lining toward the other side. This is an indication of distal pressure on the erupted permanent molar. That the germ of the unerupted second molar also moves distally is verified in Fig. 11 (frame *B* of Fig. 9). Part of the enamel (*E*) of the germ is visible to the left, while the bone to the right is absorbed. The presence of absorption is manifested by the several osteoclasts lying in Howship's lacunae (at *G*) and by the serrated surface of the bone. The implication of these findings will be discussed later.

The next three pictures originated from a young Java monkey. Fig. 12 shows the appliance used in this case. It consists of caps cemented on the

deciduous canine and first molar with lingual extension wires to the second deciduous molar and incisors on both sides. The caps were connected by a screw over the palate. Thus the distance between the right and left side of the jaw could be increased by gradual tightening of the screw. The canine and first molar were moved bodily. Fig. 13 shows a survey of a deciduous cuspid

Fig. 10.—Frame *A* of Fig. 9. *R*-distal root of first permanent molar. *G*-giant cells. *E*-enamel of unerupted second molar.

Fig. 11.—Frame *B* of Fig. 9. *E*-enamel of unerupted second molar. *G*-giant cells. Germ moves distally.

with two adjoining tooth germs, probably the future lateral incisor and canine. The deciduous canine was moved bodily in the direction indicated by the arrow. Fig. 14 shows the framed region in higher magnification. Part of the root of the deciduous tooth (*R*) lies to the left and the tooth germ is situated to the right. Between them is the periodontal membrane (*P*) of the deciduous tooth

Fig. 12.—Appliance used on Java monkey. Bodily movement of III and IV.

Fig. 13.

Fig. 14.

Fig. 13.—*C*-deciduous canine. Bodily movement. Framed area appears in higher magnification in Fig. 14.

Fig. 14.—Framed area of Fig. 13. *R*-deciduous root. *P*-periodontal membrane. *B*-bone. *O*-osteoblastic lining. *G*-giant cells.

and a bony trabecula (*B*). Toward the germ the trabecula shows signs of resorption which is indicated by osteoclasts at *G* and osteoblastic lining toward the periodontal membrane of the deciduous tooth. This resorption and deposition indicate that the germ is following the movement of the adjoining deciduous root.

All photomicrographs shown so far originated from specimens obtained by bodily movement of erupted teeth with adjoining buds. The following pictures, however, show the result of tipping movement of such teeth. Fig. 15 is a survey of a sagittal cut through the maxilla of a *Macacus rhesus* monkey. The

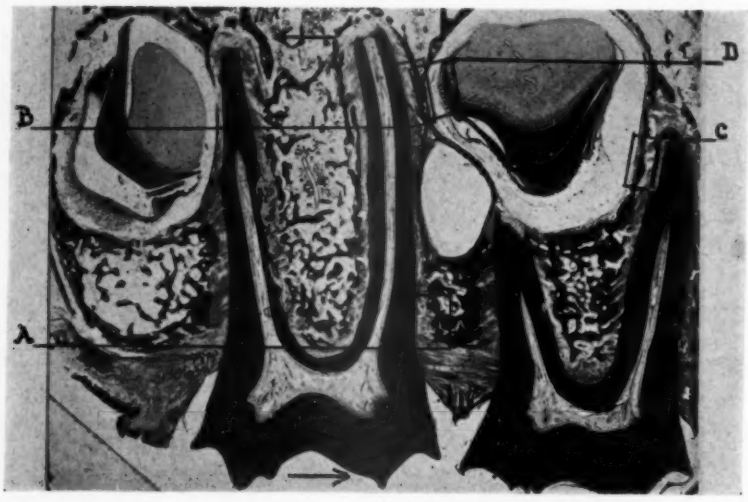


Fig. 15.—Mesiodistal section through maxilla. Tipping movement. Crown and roots move in opposite directions (arrows). Framed areas *A*, *B*, *C*, and *D* appear in higher magnification in Figs. 16, 17, 18, and 19.

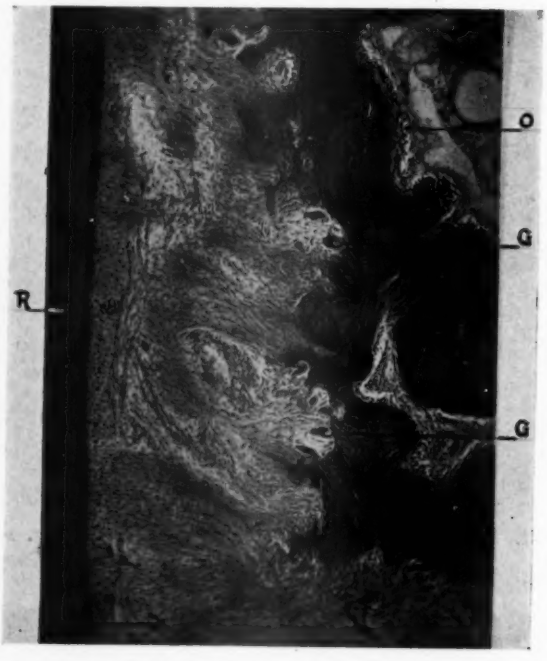


Fig. 16.—Frame *A* of Fig. 15. Cervical region of permanent molar and alveolar septum. *R*-root of permanent molar. *G*-giant cells. *O*-osteoblastic lining.

second deciduous molar and germ of the second premolar lie to the right, the germ of the second molar to the left, and the erupted first permanent molar in the middle. The erupted teeth were tipped as indicated by the arrows in Fig. 15

and verified in the following photomicrographs, which are higher magnifications of the framed areas *A*, *B*, *C*, and *D* in Fig. 15.

Fig. 16 (frame *A* of Fig. 15) shows to the left a cervical part of the mesial side of the root of the permanent molar (*R*); to the right is the interalveolar septum. This picture is a perfect example of bone resorption due to pressure. Many osteoclasts are visible (*G*), while the bone is rebuilt toward the marrow, as indicated by osteoblastic lining (*O*). Pressure in the direction of the arrow is evident.

Fig. 17 (frame *B* of Fig. 15) represents to the left the apical region of the same side of the root of the permanent molar (*R*), bordered on the right by the periodontal membrane (*P*) and a bony septum (*S*). At the extreme right, part of the tooth follicle (*F*) of the second premolar is visible. Osteoblasts line the bony septum toward the root of the permanent molar (*O*) and giant cells (*G*) are visible toward the germ. It is evident that the apical region moves in a direction opposite to the direction of the movement of the cervical region, while the adjoining germ moves in the direction of the apical region. This movement is also shown in Figs. 18 and 19.

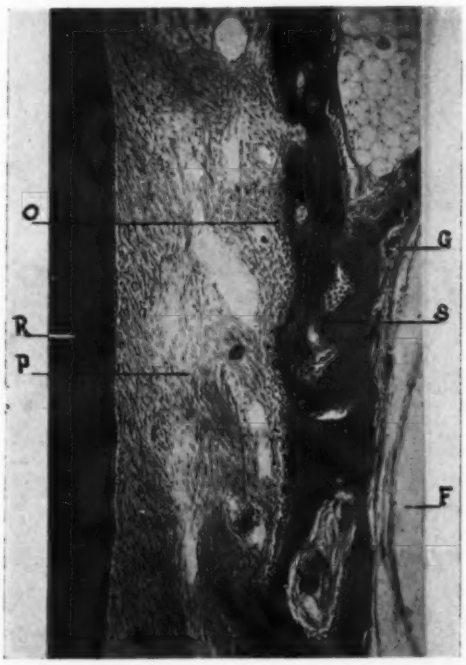


Fig. 17.—Frame *B* of Fig. 15. Apical region of permanent molar. *R*-root. *P*-periodontal membrane. *S*-septum between first molar and second premolars. *F*-follicle of second premolar. *G*-giant cells. *O*-osteoblastic lining.

Fig. 18 is a higher magnification of the framed area *C* in Fig. 15. It shows the mesial side of the germ of the second premolar (*B*) to the left, and the apical region of the mesial root of the deciduous second molar (*R*) to the right. The bony trabecula between the two structures is lined with osteoblasts toward the germ and shows all signs of bone resorption toward the deciduous root (osteoclasts at *G*). Both tooth germ and deciduous root are moving distally, as indicated by the arrow in Fig. 15.

Finally, Fig. 19 (frame *D* of Fig. 15) is a confirmation of the distal movement of the germ. The bony trabecula (*B*) to the left of the germ is resorbed toward the germ, as indicated by giant cells (*G*) and osteoblastic lining (*O*) on its other side.

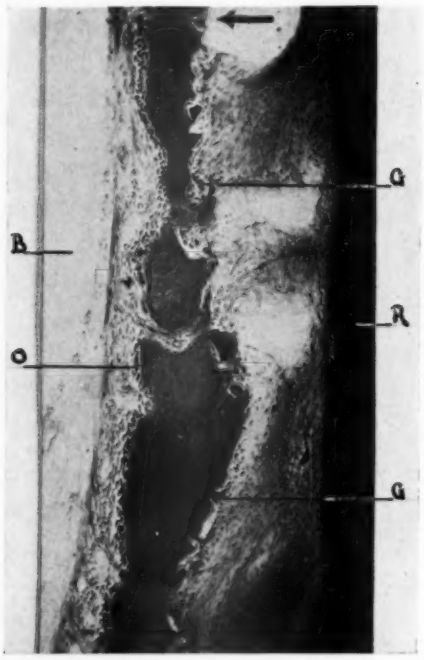


Fig. 18.—Frame *C* of Fig. 15. Germ of second premolar. *R*-root of deciduous second molar. *G*-giant cells. *O*-osteoblastic lining. Typical picture of bone transformation.

Fig. 19.—Frame *D* of Fig. 15. *B*-bone between permanent molar and germ of second premolar, all structures of which are visible to the right. *G*-giant cells. *O*-osteoblastic lining. Germ movement opposite to that of crowns of erupted teeth.

DISCUSSION

Orthodontic treatment of the deciduous dentition may have an indirect and a direct influence upon the development of the permanent dentition.

I. Indirect Influence: All authors are agreed that by correcting abnormal occlusion in a child we enable him to use his jaws in the proper manner, a condition which is essential to further normal development.

II. Direct Influence: The study of the photomicrographs reproduced here shows that orthodontic movement of deciduous teeth induces migration of the underlying or adjoining tooth germs. The direction of this migration is the same as the direction of the movement of the roots of the deciduous teeth. These facts can be deduced from the photomicrographs as follows:

In Figs. 1 to 4 a tooth germ is situated between the roots of a deciduous molar. It moves with these roots. The movement of the germ, as well as that of the roots of the deciduous molar, is indicated by the accompanying resorption and deposition.

The results in Figs. 5 to 8 were obtained by mesial movement of the deciduous and the first permanent molars. Bone deposition and resorption at characteristic locations permit the conclusion that the underlying tooth germs migrated in the same direction. In these pictures the germ of the second permanent premolar was situated *ahead* of the roots in the direction of their movement. Fig. 5 also shows the germ of the permanent second molar. That this germ also moves mesially is proved by the bone changes seen in Figs. 7 and 8. Figs. 9, 10, and 11 as well as Figs. 13 and 14 disprove the interpretation of this movement as normal mesial growth. In Figs. 9, 10, and 11 we see the germ of the second permanent molar pushed distally by a corresponding movement of the first permanent molar, and in Figs. 13 and 14 we see that the tooth germ follows a buccal movement of the adjoining deciduous root.

In Figs. 13 and 14 the tooth germ lies *behind* the moved deciduous root in the direction of the movement. Here too bone deposition and resorption indicate that the germ follows the movement of the root.

We may draw the following conclusions from the photomicrographs, Figs. 1 to 14:

A, A tooth germ situated between the roots of a deciduous tooth follows the movement of these roots. This is made possible by resorption and deposition of the surrounding bone (Fig. 20).

B, A tooth germ situated next to the roots of a deciduous tooth in the path of its movement is pushed in the direction in which the root moves (Fig. 21).

C, A tooth germ situated next to the root of a deciduous tooth and behind this root in respect to the movement is pulled in the direction of the root (Fig. 22).

Having established the effects which active orthodontic treatment of the deciduous dentition has upon the future permanent teeth, we may now discuss the implications that these effects have in regard to the period of life at which orthodontic treatment may preferably be undertaken. There is little or no disagreement among authors that the orthodontist should interfere in order to assist

nature during the developmental period by all means except treatment by appliances. This interference includes treatment of caries in the deciduous dentition, space retention of prematurely lost deciduous teeth, removal of supernumerary teeth, and promotion of the general health. But whether or not active treatment by appliances should be undertaken before the completion of the permanent dentition is a much disputed question. One of the prerequisites to the answering of this question is the definite knowledge of the manner in which treatment of deciduous teeth influences further development. Because of the great variety of anomalies no general rule can apply to all cases. It is not the chief purpose of this paper to analyze the advisability of treatment by appliances in different types of anomalies at certain ages. It is intended rather to clarify the question of whether treatment of the deciduous dentition can have the desired effect on the permanent teeth. A few examples of indicated early treatment, however, will be given.

Present literature gives no definite answer as to the best age in which to institute necessary orthodontic treatment. Some authors advocate treatment as early as the third year of life; others maintain that it is preferable to begin after completion of the permanent dentition. Treatment is also held to be indicated only during certain periods of active growth of the skull.

Angle's textbook[5] (page 309) says, ". . . it becomes an axiom that the proper time to begin treatment is as near the beginning of the variation from the normal in the process of the development of the dental apparatus as possible. . . ." He continues on page 311, "Unless some unusual physical condition of the patient exists it is unquestionably a serious mistake without the least argument in its favor to defer the operation until all the teeth shall have erupted. . . ."

Charles R. Baker,[6] in an article entitled "Time for Corrective Orthodontic Treatment," writes, "I am firmly of the opinion that the deciduous dental arches should receive corrective orthodontic treatment in cases where there is abnormal arch form in a marked degree, in cases where there is abnormal anteroposterior arch relationship, in cases of a cross-bite, in cases where there is a lack of occlusion of the posterior teeth, and in cases of open bite. . . . the treatment should be applied at a time when the roots of the deciduous teeth are fully developed and no absorption of them has occurred, for at this time there is a minimum of development of the permanent teeth."

Dewey-Anderson's textbook, *Practical Orthodontia,*[18] says concerning the time of treatment, "The most opportune time to begin the treatment of a case of malocclusion varies with each individual. In years past it was not uncommon to hear the statement made that treatment should not be undertaken until the child was about twelve years of age. . . . In the past years, however, orthodontists and general dentists seemed to feel that the earlier the treatment the better."

Milo Hellman,[7] in an article entitled "Growth of the Face and Occlusion of the Teeth," writes, "When, however, I do find that orthodontic treatment cannot be avoided I try to adjust the time of mechanical interference to the period of most active growth." In another paper entitled "Failures in Orthodontic Treatment" Hellman writes, "Because of our ability to do, and because of the

inference that the earlier the treatment is started the better it is, we are often liable to, and many actually do, start orthodontic treatment too early. The inevitable result is an inordinately long period of treatment, overworked teeth and surrounding tissues, sometimes the onset of caries and often mechanical abrasion, unfavorable physiologic conditions and obscure psychologic disturbances. What is most distressing is that when treatment is started too early the orthodontic results are never satisfactory."

John V. Mershon[9] writes, "The fact is, some operators begin cases too soon. There is too much treatment of the deciduous denture. . . . I presume the belief which impels orthodontists to begin work in the deciduous denture is that corrections, made early, will be reflected in an improvement of the permanent teeth and alveolar process when they develop. This reasoning is fallacious because the deciduous alveolar process goes with the loss of the deciduous teeth and the permanent teeth are supported by a new alveolar process which develops as the teeth erupt . . . it makes us wonder why orthodontists feel that they, through treatment, can influence the permanent dentition for the better, when natural growth processes so often operate in the opposite direction. What generally results from treatment of the deciduous denture is an increased rapidity of the resorption of the roots of the deciduous teeth and, in consequence, of the deciduous alveolar process."

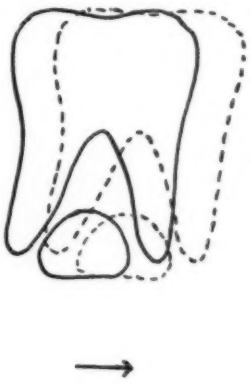


Fig. 20.

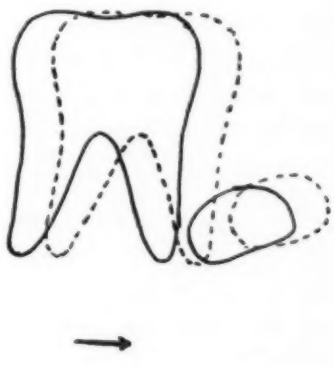


Fig. 21.

Fig. 22.

Robert H. W. Strang[15] in his *Textbook of Orthodontia* (page 366) takes a very broad view of the problem, advocating various rules to be observed. "While denture growth is distributed over a long period of years, yet, at various times, there is growth acceleration at localized areas. Consequently, from a physiologic standpoint, it is good judgment to inaugurate mechanical stimulation of growth activities at the age that corresponds to the normal growth period for the particular location requiring help or as soon after this time as the orthodontist decides that normal growth is inadequate." Speaking about certain cases of lacking interproximal developmental spacing, Strang says (page 366), ". . . it is safe to conclude that such a case needs mechanical interference not later than at six years of age." And speaking of faulty mesiodistal relationship of the body of the mandible with the cranial anatomy, Strang states (page 377), ". . . the sooner all errors that lead to the establishment of such conditions are

corrected, the better for the patient.'' But Strang also gives (page 368) the following rules:

''1. It is not safe to move lateral incisor teeth when their roots are so closely associated with the crypts surrounding the crowns of the permanent canines.'' (Because of root resorption.)

''2. Moving the permanent and deciduous molars distally at this early age will not take the crypts of the premolars and canines with them because the roots of the deciduous molars, at least those of the first deciduous molars, are too far absorbed to influence the underlying crypts of the premolar teeth and there is no possible way of overcoming the abnormal mesial position of the crypts of the permanent canines. . . . Therefore it seems much better to delay all treatment until such time as all tooth movements can be coincidentally effected. . . .'' Strang gives no histologic evidence in support of his opinion.

The histologic sections shown in this paper may give some information about the influence of deciduous tooth treatment on the permanent successors. It does not seem impossible that a certain type of treatment (as for example the strong forces of an edgewise or ribbon arch) may be responsible for some discrepancies found between the histologic pictures and the experience described by Strang.

We may conclude this review of current literature on the subject of proper time for orthodontic treatment by quoting the opinion of Leuman M. Waugh:[19] ''It has been my conviction for many years and I have taught my students, that orthodontic treatment should be begun as soon as a condition becomes sufficiently pronounced to be apparent that nature cannot correct it unassisted. . . . I emphasize that orthodontic treatment does not imply the placement of appliances only but that it may conveniently be divided into seven stages as follows:

1. Physiologic—thorough use in mastication, correct speech, and breathing
2. Psychologic—habit breaking, etc.
3. Exercisers—bite strap, odontobell, etc.
4. Myofunctional therapy
5. Medical—pediatrics, rhinologics
6. Surgical—removal of supernumerary teeth, exposure of impactions, cleft palate, cleft lip
7. Appliance therapy.''

According to Dr. Waugh's opinion, 30 to 50 per cent of anomalies in the permanent dentition requiring orthodontic treatment by a specialist could be avoided by proper measures taken during development.

In considering the proper time for treatment we must also remember the potential damage done by early treatment. Kronfeld[2] says, ''Radiographs of teeth subjected to orthodontic treatment in early life sometimes show blunted, shortened roots, different from other roots in the same mouth. The history of these teeth suggests that some force may have deformed the developing root ends. Johnson, Appleton, and Rittershofer[3] found that Hertwig's sheath at the open foramen of a young, moved tooth showed a distinct deformity that was

not present in a control tooth of the same animal. In the experiments of Gottlieb and Orban root deformities were produced by applying orthodontic forces to very young teeth. In these teeth Hertwig's sheath appeared deformed and folded. If an animal was kept alive long enough to allow the apex to form completely, a corresponding deformity was found in the root end. The entire root was shorter and blunter than the control teeth of the same animal."

These observations deal with the movement of incompletely developed permanent teeth. They seem to refer to the results of exerting excess strain rather than gentle orthodontic forces. Nevertheless we cannot exclude the possibility of damage being done to Hertwig's sheath of tooth germs by moving them indirectly, as through deciduous tooth movement. Such evidence of potential damage done to tooth germs by traumatic injuries was given by Weinmann and Kronfeld[4] in a recent publication. The authors show in photomicrographs of human unerupted teeth disturbances in the region of Hertwig's epithelial sheath and elsewhere due to pressure phenomena during physiologic growth processes. It is conceivable that such damage may also occur under the additional stress of orthodontic movements. These possibilities should be kept in mind.

Histologic investigation shows that judicious treatment of the deciduous dentition can influence the permanent successors. We may now, therefore, approach the problem whether in certain cases early orthodontic treatment would not be more desirable than late treatment. Let us first consider the advantages of early orthodontic treatment. These advantages may be summarized in one word—prevention. The prevention of more aggravated cases of malocclusion is the primary objective.

Indications of future malocclusion of permanent dentition may be in evidence early in the development of the deciduous dentition. These indications may be summarized as:

1. Lack of proper spacing between teeth,
2. Improper interdigitation,
3. Faulty mesiodistal relationship of jaws (Class II and Class III).

The advantages of correction of these early symptoms of later and more aggravated cases of malocclusion are numerous. Some conditions (e.g., lack of space) lead invariably to more extensive anomalies and others (e.g., false interdigitation) can never correct themselves. Therefore in such cases prompt interference is imperative as a prophylactic measure. Early treatment is further indicated in all cases of faulty mesiodistal relationship of the jaws (Class II and Class III). Some—we know by experience—will not respond sufficiently to treatment after the completion of the permanent dentition, after bone and muscles have functioned in the wrong relationship for many years. This applies definitely to Class III cases; many cases of Class II will also be brought to a better functional and cosmetic result if their correction is attempted early.

This statement is not intended to advocate the active correction of all anomalies of the deciduous or mixed dentition. Some conditions often correct themselves and therefore require no interference. Examples of such cases are

diastemas, lingually erupting lateral incisors (especially in the mandible) and certain rotations, conditions which are often nothing else than the persistence of typical germ positions in the jaws. Their spontaneous correction sometimes occurs belatedly, during the completion of the root after eruption. Generally speaking, most anomalies occurring before the sixth year of life do not concern single teeth, but rather groups of teeth, entire jaws, or their relationship. Corrections of such anomalies often do not require highly specialized or complicated appliances. A split plate employed to widen the deciduous arch, which acts on the teeth as well as on the palate itself, may be of more benefit than a complicated appliance in the permanent dentition after consequences of lack of space have manifested themselves. An oblique plane may be used in a child of three or four years to correct a faulty relationship between the maxillary and mandibular incisors which sometimes forces the mandible into a Class III position. This may obviate the later necessity of using complicated appliances which, in addition, almost never achieve an ideal cosmetic effect. Even though a permanent success may not be guaranteed, the chances are worth taking.

Let us now consider the possible claims against early treatment. They have all been presented earlier but may be now summarized as

1. Lack of effective or desired results upon the permanent successors,
2. Prolonged period of treatment,
3. Developmental disturbances of permanent teeth (potential disturbances of Hertwig's epithelial sheath resulting in the possibility of root deformities).

There is very little validity in such dangers. The first two objections have been answered in the previous discussion. The histologic evidence presented shows that the correction of the deciduous dentition may produce comparable results upon the permanent dentition. If the objective of prevention of malocclusion in the permanent dentition is attained, then the period of treatment is certainly considerably shortened and not prolonged. There remains but the one question of producing root deformities of the permanent dentition. It is quite true that the findings of Weinmann and Kronfeld indicate traumatic changes during the development of the dentition probably due to indirect pressure phenomena such as interosseous fluids on a physiologic basis. It may be argued that if traumatic changes may be produced on a physiologic basis then surely such traumatic changes should be decidedly more marked under direct pressure induced by artificial means. To answer this contention it is necessary to point to the fact that the evidence of traumatic changes by Weinmann and Kronfeld is not gross but microscopic. Although this has an important academic interest one cannot ascribe any practical significance to these findings. While traumatic changes produced by the methods advocated for early correction cannot be discovered it may be emphasized that the forces in such treatment are also on a physiologic basis and the resultant traumatic changes therefore cannot present any problem of practical significance.

One more general statement. Whatever one's opinion about the proper time for orthodontic aid, the disadvantages of early treatment should not be too emphatically preached. The physician, the practitioner of general dentistry, and, through both, the layman, do not always distinguish between treatment by

appliances and prophylactic measures. Thus the theory that late orthodontic aid is more advantageous may prevent the patient from asking the timely advice of a specialist who perhaps would have been able, with simple means—and sometimes without mechanical treatment—to prevent the development of more serious conditions.

Our considerations of the proper time for treatment were based upon conclusions drawn from the histologic findings which were summarized on page 1163 as A, B, and C (Figs. 20, 21, 22). For a beneficial treatment in the deciduous dentition, however, another consideration is essential. ***Avoid any appliance which is liable to produce tipping of deciduous teeth.*** We come to this conclusion from studying the histologic pictures reproduced in Figs. 15 to 19. These figures show the result on the adjoining germs of tipping of teeth.

The photomicrographs show that rules A, B, and C apply to tooth germs in their relation to the adjoining *roots* of erupted teeth, independent of the direction in which the crowns of these teeth are shifted. We see, therefore, that the movement of the roots and *not of the crowns* is the decisive factor in the influence on underlying or adjoining tooth germs (Fig. 23). Since this is so, the question of the manner in which the roots of teeth are influenced by orthodontic movement of their crowns gains paramount importance. A thorough understanding of the mechanical principles involved in tooth movement seems essential, for we shall see that the manner in which the root of a moved tooth reacts can vary greatly according to the appliance used.

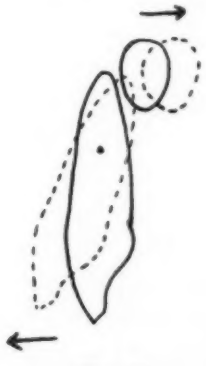


Fig. 23.

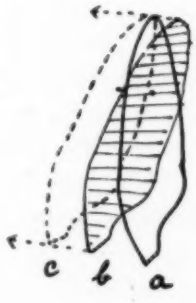


Fig. 24.

Fig. 24.—Possible combination of physical and biologic action of a force on a tooth.
a-original position.
b-result of physical action (rotation center in the apical third of the root).
c-result of combined physical and biologic action (rotation center at the apex).

The reaction of the root of a tipped tooth, or, more exactly, the location of the point of rotation, has been very much disputed in literature. Oppenheim[20] quoted by Strang[15] in his *Textbook of Orthodontia* says, on page 192, "When a tooth is tipped by a force it does not represent a two-armed lever, as formerly thought, but is a one-armed lever, the apex of the root serving as a pivot or center of motion." But in 1936 Oppenheim states[21] that it is impossible to imitate normal speed of tooth movement and consequently a two-armed lever results after forty days in monkeys and after eight to ten weeks in humans.

A. M. Schwarz[22] comes to the conclusion that in tipping movements of teeth the point of rotation is ordinarily situated in the apical third of the root.

Rudolf Winkler[23] gives a thorough analysis of the mechanical principles involved in orthodontic movement of teeth and concludes that the point of rotation may be situated at different locations under varying conditions.

Calvin Case[24] states that a tooth imbedded in a yielding medium and subjected to a force attached at its crown "is practically a lever, responding approximately to the same laws which govern levers everywhere under like conditions of stress." He upholds that the actions of several types of levers are combined in the "inclination" of a tooth and a point of rotation situated at the end of the apical third of the root would result.

Kronfeld in Dewey-Anderson's textbook[18] summarizes this problem: "Thus at present we are faced with two different opinions concerning the location of the fulcrum in tipping movements of teeth: 1) Oppenheim's conception of the fulcrum located at the apex and 2) the findings of Case,[24] Johnson, Appleton, and Rittershofer,[3] Schwarz,[22] and Gottlieb and Orban,[25] who show a position of the fulcrum slightly apical from the middle of the root. . . . In his recent report 'The Crisis in Orthodontia' Oppenheim[26] explains the difference between his own findings and those of the other authors mentioned above by the difference in the intensity of the force. He states that if very gentle forces are applied, the bone changes are identical over the entire length of the root, decreasing in intensity toward the apex, which latter is stationary."

In reference to these differences of opinion, Allan G. Brodie[27] suggests, "When a sufficiently extensive and carefully controlled research is conducted on this question it will probably be discovered that both sides are right in their assertions under given conditions. Judging solely from clinical observation of many cases, which involve various types of mechanics, it seems possible to bring about either of the two conditions—and others in addition." An attempt will be made to demonstrate that, indeed, both schools of thought are compatible:

In tipping a tooth in an individual, and not in a lifeless medium, we must consider two factors, the physical, which would apply to any post or tooth imbedded in a medium, and the biologic. The physical action of a tipping force undoubtedly produces a fulcrum somewhere within the tooth, under usual circumstances in the apical third of the root. If, however, only gentle forces are applied, and therefore the dislocation of the tooth ensues very slowly, the biologic factor may modify the purely mechanical action (Fig. 24). This biologic factor is the stimulation of growth of the organ (bone) in the direction of the applied force. Thus the theater of physical action may be shifted in the direction of the force and, under favorable circumstances, the result can be the same as that achieved from tipping around a point of rotation at or near the apex.

The situation of the point of rotation in tipping movement of teeth is of great importance. It determines the manner of motion of the root, and we shall see that it can be influenced to a certain degree by the operator.

In an article dealing with the mechanics involved in moving teeth the author[28] discussed the situation of the point of rotation. Because of the practical importance of this location we wish to summarize in translation part of this article: The influence of a force on a tooth depends on

A. A number of biologic factors varying in different individuals. These are such factors as ability of bone deposition and resorption, speed and grade of

calcification, connective tissue reactions, etc. These factors are, practically speaking, beyond our influence.

B. A number of physical factors which need to be well understood although some of them are also beyond our control. They are

1. The shape and length of the root,
2. The resistance of the surrounding tissues.

(This resistance varies at different locations surrounding a root, and the distribution of points of higher or lower resistance determines greatly the resultant movement.)

3. The manner of the application of the force (stationary or simple anchorage),
4. The intensity of the force applied,
5. The direction of the force applied,
6. The location of the application of the force.

Points 1 and 2 are beyond the operator's control. Points 3, 4, 5, and 6 can be affected by the design of the appliance. We see, therefore, that although the location of the center of rotation cannot be exactly determined it can be influenced to a certain degree by the operator.

Fig. 25. Fig. 26. Fig. 27.

Figs. 25 to 27.—25, Point of rotation within the root. 26, Point of rotation outside the root. 27, Point of rotation at infinity.

The location of the point of rotation, however, determines the type of movement produced. This point of rotation is usually situated in the longitudinal axis of the tooth and may be located within the tooth itself (Fig. 25). In the latter case, the crown of the tooth and the part of the root extending up to the level of the point of rotation are dislocated in the direction of the force. All parts of the tooth beyond the level of the point of rotation move in the opposite direction. Therefore, the nearer the point of rotation lies to the apex, the smaller is the part of the root which moves in the direction opposite to the force applied. This part becomes nil if the point of rotation is situated exactly at the

apex. In other words, if the point of rotation lies at the apex, the entire tooth moves in *one* direction, in a different degree at different levels.

As long as the point of rotation lies within the root we speak of tipping of the tooth. The point of rotation may, however, be situated in the continuation of the longitudinal axis of the tooth, somewhere without the tooth (Fig. 26). If it is far enough from the tooth, we deal with a so-called bodily movement in which all parts of the tooth move to a considerable degree in the same direction. If the point of rotation is assumed to be at infinity, the tooth moves parallel to its original position (Fig. 27).

While points 1 and 2 are beyond our control, we may voluntarily vary points 3, 4, 5, and 6, which influence the point of rotation in the following manner:

In regard to point 3 (manner of application): If the force is attached at one point, or hinged (whereby the axis of the hinge and the axis of the tooth run in different directions) the point of rotation will be within the root. Practically speaking, the tooth will be tipped. If, however, the force is attached rigidly, the point of rotation will be outside of the tooth. In other words, the tooth will move bodily. (Angle's textbook says about bodily movement, "Stationary anchorage is that form in which the attachment to the anchor tooth is essentially rigid so that its tipping is impossible, and if moved at all, it must be dragged bodily through the alveolar process in an upright position.")

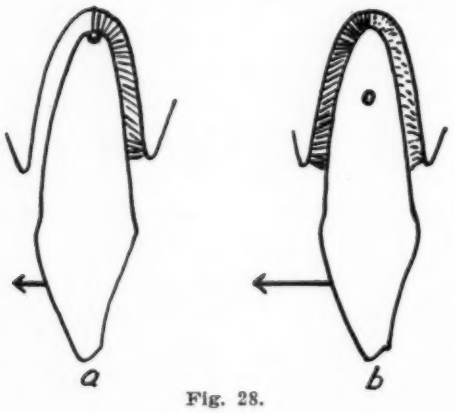


Fig. 28.

In regard to point 4 (intensity): The stronger the force the nearer will be the point of rotation to the point of application of the force, and the farther from the apex. In other words, the stronger the force, the larger the part of the root that moves in the direction opposite to that of the applied force. There are several reasons for this phenomenon. A tooth in its socket does not behave like a post driven into a homogeneous medium because it is suspended in the alveolus by the fibers which constitute the periodontal membrane. In the application of very gentle forces the fibers on the side of presumable pressure are merely relaxed, and actual pressure and resistance does not occur (Fig. 28*a*). Under such conditions there is only tension on the side of negative pressure (pull). The point of rotation then will be approximately at the apex. If we increase our force we will create actual pressure on one side and tension on the

other side. Under such conditions there will be resistance on both sides (Fig. 28*b*) of the root and the behavior of the tooth will be more comparable to the lifeless post in the ground. (There the center of rotation is within the root.) If very strong forces are applied, we may even crush the periodontal membrane on one point or another, and thus create direct contact between root and bone which will act as a fulcrum. In such a case the point of rotation will necessarily be at the level of the fulcrum (Fig. 29).

In regard to point 5 (direction): It makes a difference whether the direction of the applied force travels as indicated in Fig. 30*a*, pointing toward the crown, or as indicated in Fig. 30*b*, pointing toward the root. Because the tooth is fixed in the alveolus, a force pointing toward the crown (Fig. 30*a*) will be split into two components (the original force or resultant being the diagonal of a parallelogram of forces). One component acts at a right angle to the longitudinal axis of the tooth (horizontally), the other acts parallel to that axis (vertically) tending to pull the tooth out of the alveolus. The fibers of the periodontal membrane will be tightened and no active pressure will be created by this second vertical component of the force. Therefore the point of rotation will be near or at the apex or even outside the tooth, as illustrated in Figs. 26 and 31*b*. The location will vary according to the value of the vertical component. There is, of course, a practical limit to the increasing of that vertical component. The vertical component is increased by pointing the force more toward the crown and it tends to pull the tooth out of the socket and therefore loosen it.

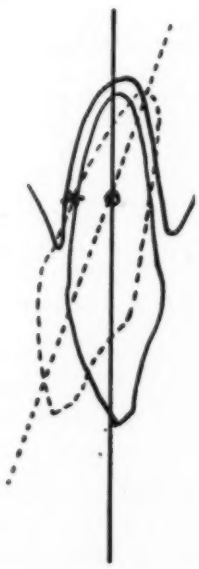


Fig. 29.

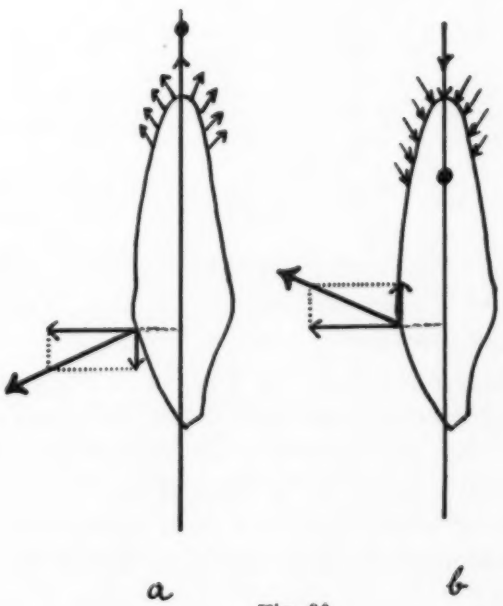


Fig. 30.

A force pointing toward the root will be split up in a horizontal and vertical component. The vertical component will now point toward the apex and tend to press the tooth into the alveolus (Fig. 30*b*). This active pressure will tend to create a center of rotation within the root. The results of the two conditions are illustrated in Fig. 31. (We shall encounter similar vertical com-

ponents of forces when we shall differentiate between pushing and pulling forces. It is the direction of these vertical components which influences the location of the center of rotation.)

In regard to point 6 (location of the application of the force): The nearer the point of application of the force is situated to the gingival attachment, the closer the point of rotation moves toward the apex. The reason for this phenomenon is that the same force applied nearer to the alveolus acts under less leverage and therefore acts as a weaker force (Fig. 32). As pointed out in point 4 a weaker force tends to create a center of rotation nearer the apex.

It also makes a difference whether the tooth is pulled or pushed, that is, whether the point of application of the force is in front of or behind the longitudinal axis of the tooth. If the tooth is pulled, the point of rotation lies closer to the apex than does the point of rotation of the pushed tooth, all other factors

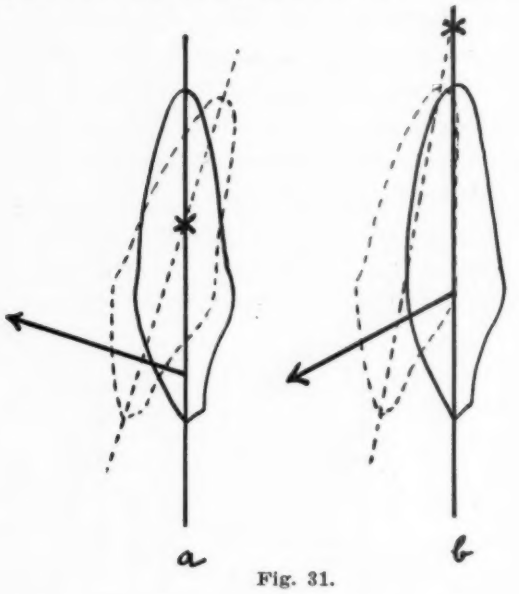


Fig. 31.

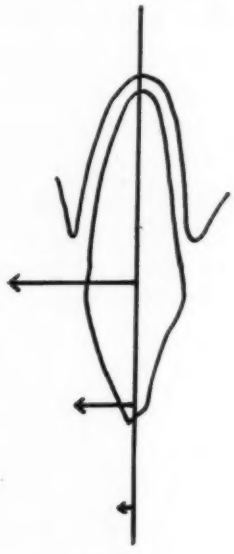


Fig. 32.

being equal. (The force applied in ligating a tooth to a labial archwire is a *pushing* force.) The reasons for the difference in action between a pushing and a pulling force are:

A pushing force (f in Fig. 33*a*) which acts on a tooth in a direction at a right angle to the longitudinal axis of the tooth must act at an acute angle (α in Fig. 33*a*) to the line connecting the area of the center of rotation with the point of application (line a—b in Fig. 33*a*). The force is therefore split into two components. The first acts at a right angle to the line a—b and the second acts in the direction of this line, pointing toward the apex (pressing the tooth into the alveolus).

A pulling force (f in Fig. 33*b*) which acts on the tooth in a direction at a right angle to the longitudinal axis of the tooth must act at an obtuse angle (β in Fig. 33*b*) to the line connecting the area of the center of rotation with the point of application (c—d in Fig. 33*b*). The force is therefore divided into two component forces. One component acts at a right angle to the line c—d and the other acts in the direction of this line, pointing toward the crown (pulling the tooth out of the alveolus).

Both pushing and pulling forces can be divided into components. The *pushing force* produces a component which always pushes the tooth into the alveolus and creates pressure in the periodontal membrane. This pressure, as explained in point 5, tends to create a center of rotation within the root (in the apical third).

The *pulling force* split up into its components always produces a component which acts in a direction toward the crown, pulling the tooth out of its alveolus and thus tightening the fibers of the periodontal membrane. This tension, as explained in point 5, tends to move the center of rotation toward the apex or even beyond the apex as in Fig. 31*b*.

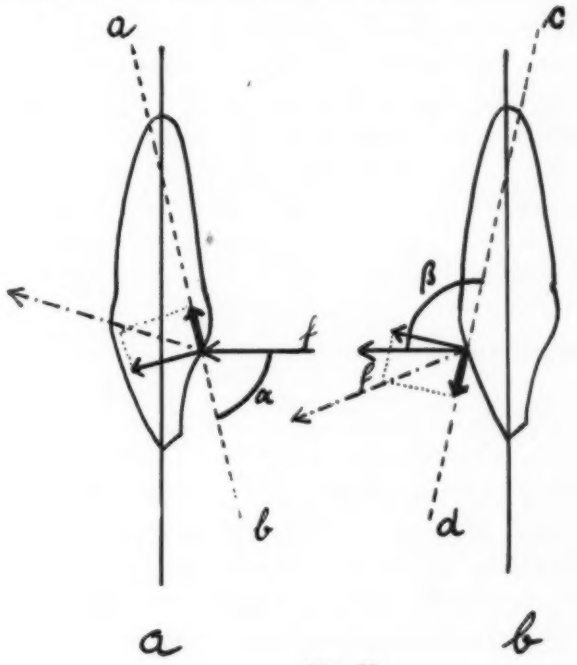


Fig. 33.

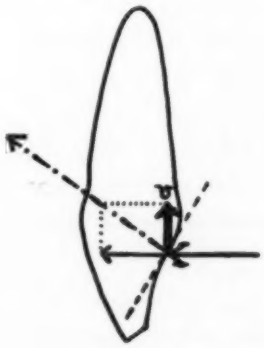


Fig. 34.

The pushing force of an auxiliary spring often tends to move the center of rotation up into the root for an additional reason. The tendency of the spring to slip along an oblique surface of the crown may be counteracted by auxiliary wires. However, one component of the force parallel to the long axis of the tooth remains active. If this component acts toward the apex (*v* in

Fig. 34), a force acting in a direction toward the apex presses the tooth into its socket and thus the center of rotation moves more toward the crown (see also Fig. 30*b*).

The suggestions given should be considered in designing any orthodontic device because they determine in part its resulting effect. By acting upon them we are able to vary the location of the point of rotation by our choice of appliance and its particular design and usage. Their observation is of especial importance in designing appliances for young children as long as there are tooth germs in the jaws.

Practically speaking, if we are to obtain favorable results from orthodontic treatment in young children, we should attempt to use appliances which do not produce tipping of teeth. The result of a tipping appliance is never ideal. It may vary, however, according to the degree and type of tipping produced. If the treatment is performed very slowly and other factors do not act to create a center of rotation far from the apex within the root, natural growth stimulation, or the forces of occlusion, may counteract the creation of such an unfavorably located point of rotation. The resultant benefit will then be doubtful. If the mechanical and biologic factors involved are more unfavorable, we are apt to produce a tipping of teeth with the center of rotation far within the root. In this case the future permanent dentition may be adversely influenced.

SUMMARY

Histologic investigation of experimentally moved deciduous and permanent teeth and their surrounding tissues reveal:

Orthodontic movement of teeth of the deciduous or mixed dentition produces migration of underlying and adjoining tooth germs. This is made possible by bone resorption and deposition. Hence orthodontic treatment in the deciduous dentition can affect the development of the permanent successors.

The direction in which tooth germs move corresponds to the direction taken by the roots of the adjacent erupted teeth. Therefore movement of the roots of these teeth in the proper direction is essential.

Displacement of the roots of teeth in the same direction as their crowns are shifted is assured only if tipping movements are avoided. Where tipping appliances must be used observation of the following rule may help to keep the center of rotation near or at the apex: "Use *weak* forces, applied *near the gingival margin,* in a *pulling* manner and in a direction *never pointing toward the root.*"

I wish to extend my appreciation to Dr. Leuman M. Waugh and Dr. Moses Diamond of Columbia University School of Dental and Oral Surgery for their generous aid. I should also like to thank Mr. Alexander Leff and Mr. Irving Weinberg for their assistance.

REFERENCES

1. Breitner, C., and Tischler, M.: Ueber die Beeinflussung der Zahnkeime durch orthodontische Bewegung der Milchzähne, Zeitschr. für Stomatol. No. 23, 1934.
2. Kronfeld, R.: Histopathology of the Teeth, Philadelphia, 1939, Lea and Febiger.
3. Johnson, A. L., Appleton, J. L., and Rittershofer, L. S.: Tissue Changes Involved in Tooth Movement, INT. J. ORTHODONTIA 12: 889, 1926.

4. Weinmann, J., and Kronfeld, R.: Traumatic Injuries in Jaws of Infants, J. Dent. Res., August, 1940.
5. Angle, E. H.: Treatment of Malocclusion of the Teeth, Ed. 7, Philadelphia, 1907, S. S. White.
6. Baker, C. R.: Time for Corrective Orthodontic Treatment, INT. J. ORTHODONTIA **19**: 1089, 1933.
7. Hellman, M.: Some Biologic Aspects, INT. J. ORTHODONTIA **23**: 761, 1937.
   Idem: Growth of the Face and Occlusion of the Teeth, INT. J. ORTHODONTIA **19**: 1116, 1933.
   Idem: Failures in Orthodontic Treatment, INT. J. ORTHODONTIA **22**: 343, 1936.
8. Hopkins, S. C.: Timing Orthodontic Procedures, J. A. D. A. **26**: 1067, 1939.
9. Johnson, A. L.: Early Orthodontic Treatment, Dental Cosmos, July, 1924.
10. Lewis, S. J.: Proper Time to Start Orthodontic Treatment, J. A. D. A. **20**: 693, 1933.
11. Lischer, B. E.: Orthodontics, Philadelphia, 1912, Lea and Febiger.
12. McCoy, J. D.: Applied Orthodontia, Philadelphia, 1935, Lea and Febiger.
13. Mershon, John V.: Failures, INT. J. ORTHODONTIA **22**: 338, 1936.
14. Northcroft, G.: Malocclusion of Deciduous Dentition, INT. J. ORTHODONTIA **16**: 714, 1930.
15. Strang, R. H. W.: Textbook of Orthodontia, Philadelphia, 1933, Lea and Febiger.
16. Waugh, L. M.: Report of Cases of Early Treatment, INT. J. ORTHODONTIA **11**: 558, 1925.
17. Breitner, C.: Bone Changes Resulting From Experimental Orthodontic Treatment, AM. J. ORTHODONTICS **26**: 521, 1940.
18. Dewey-Anderson: Practical Orthodontia, St. Louis, 1935, The C. V. Mosby Co.
19. Waugh, L. M.: Personal communication.
20. Oppenheim, A.: Tissue Changes Particularly of the Bone Incident to Tooth Movement, Am. Orthodont. **3**: 2, 1911.
21. Oppenheim, A.: Biologische Therapie und Wirklichkeit, Vienna-Berlin, 1936, Urban and Schwarzenberg.
22. Schwarz, A. M.: Gewebsveränderungen bei Orthodontischen Massnahmen, Fortschr. der Orth. Nos. 3 and 4, 1931.
23. Winkler, R.: Lehrbuch der Orthodontischen Mechanik, Munich, 1933, I. F. Lehman.
24. Case, C. S.: Dental Orthopedia, Chicago, 1921, Case Pub. Co.
25. Gottlieb, B., and Orban, B.: Die Veränderungen der Gewebe bei übermässiger Beanspruchung der Zähne, Vienna, 1931, Thieme.
26. Oppenheim, A.: Crisis in Orthodontia, INT. J. ORTHODONTIA **19**: 1933; **20**: 1934, and **21**: 1935.
27. Brodie, A. G.: In Gordon's Dental Science and Dental Art, Philadelphia, 1938, page 213, Lea and Febiger.
28. Breitner, C.: Mechanik der Zahnbewegung, Zeitschr. für Stomatol. No. 17, 1933.

DISCUSSION

Dr. Leuman M. Waugh.—I know that we are not here for lengthy remarks, but I do want to say that when Dr. Breitner showed me the work that he had done some little time ago, part of which was published in Vienna, I urged him to present it to you as he has done today. I think he has brought out the point that not only do we want pressure applied, but more important we want to know what changes that pressure will produce. We must apply it within certain rather definite limits in its relationship to the tooth surface. When this paper is published, the illustrations will be shown, and I commend to everyone the study of what has been given us because so often we may have been bringing about in the apical half of the root a movement opposite in direction to that intended. This fact favors the use of an exact mechanism, such as the edgewise. With this the band is placed in the middle third of the crown, and men who learn to manipulate this appliance tend to produce a pressure from a uniform relation to the long axis of the crown and of the root. The students with whom I have had the happy privilege of working know that I have always emphasized the importance of "thinking into the tissue." Don't let the gauge of your movement be judged from the change that you make in the position of the crown of the tooth. That is entirely secondary. What you must think of is the change that you bring about in the supporting tissues as a result of pressure and the series of changes in which certain parts of the structure are resorbed and certain other parts built up. I feel that the permanent character of our work will be improved if we think of and are guided by that change, realizing fully the varying effects of strong or gentle pressures. This will be important in planning for the expected result. I consider this contribution of Dr. Breitner's as one of value, and I commend it to your careful study.

THE PRESENT STATUS OF VITAMIN THERAPY

FREDERICK F. TISDALL, M.D., F.R.C.P. (C.), TORONTO, CAN.

NO BRANCH of medical science has made more rapid advances in recent years than has the science of nutrition, particularly as it concerns our knowledge of the vitamins. This afternoon we will briefly discuss what vitamins have been demonstrated as necessary for human nutrition, how this information has been obtained, the effect of a lack of the vitamins under consideration, just where we get these vitamins, and just how we should regard the vitamins from the standpoint of the medical practitioner.

Approximately fifteen vitamins have been demonstrated from animal experimental work. Nine have been shown to be necessary for human nutrition. These are vitamin A; four members of the vitamin B complex, namely, B_1 (or thiamin), B_2 (or riboflavin), nicotinic acid, and vitamin B_6; vitamin C, the antiscorbutic vitamin; vitamin D, the antirachitic vitamin; vitamin E, the vitamin concerned with normal reproduction, and vitamin K, the anti-hemorrhagic vitamin.

Vitamin A.—A lack of vitamin A results in profound changes throughout the whole of the body. The columnar cells of the mucous membranes throughout the body tend to become squamous in type, thus are incapable of performing their normal functions. In humans, the obvious evidence of a marked lack of this vitamin is the disease known as xerophthalmia. However, a much smaller deficiency of this vitamin results in the development of night blindness, or inability of the eyes to adapt themselves to changes of light intensity. Vitamin A is widely and abundantly distributed in such food as milk, cream, butter, eggs, liver, colored vegetables, such as spinach, lettuce and carrots. It is also present in high concentration in most fish liver oils. It is seen from this that if a person takes any reasonable sort of diet, it will be most unusual to encounter any evidence of vitamin A deficiency.

Vitamin B_1 (thiamin.)—A lack of this vitamin results in the development of the disease known as beriberi or polyneuritis. It is definitely connected with the carbohydrate metabolism of the body, in that the oxidation of pyruvic acid cannot be completed in the absence of this vitamin. A lack of this vitamin also results in a lack of tone of the intestinal tract. Our three best sources of vitamin B_1 are yeast, wheat germ, and pork. Unfortunately in the milling of wheat, the wheat germ is removed. A study of the consumption of Canadian foods shows that no less than 44 per cent of the calories consumed is essentially devoid of this vitamin. Vitamin B_1 is present in most vegetables and fruits, but not in large amounts. From the food standpoint we should regard as the best sources of vitamin B_1, whole grain cereals (either whole wheat or rolled oats), liver, egg, pork, and most vegetables and fruits, particularly peas and beans.

Reprinted from the *Academy of Medicine Bulletin*, May, 1940.
Read before the Great Lakes Society of Orthodontists, Toronto, Oct. 28, 1940.

From the medicinal standpoint, B_1 can be obtained in pure crystalline form in tablets, in yeast, and in wheat germ.

Vitamin B_2—Riboflavin.—In 1926, it was demonstrated that what was formerly known as vitamin B consisted of at least two factors, one, vitamin B_1, which as already mentioned prevents beriberi, and a second factor which apparently was of importance in the prevention of pellagra in humans. In 1933, vitamin B_2, or riboflavin, was demonstrated. It was found to be necessary for the growth of rats, and a lack of it resulted in premature aging, loss of hair, and development of cataract. Its need in human metabolism, however, was not shown until this last year, by Sebrell. He demonstrated that a lack of this vitamin resulted in the development of an angular stomatitis; the mucous membranes of the lips were thin, shiny and denuded, and there was a scaly, greasy desquamation in the nasolabial folds, on the alae nasi in the vestibule of the nose, and in some instances on the ears and eyelids. It is interesting to note that the need of this vitamin in animal metabolism was known for six years before its need in human metabolism was demonstrated.

Nicotinic acid.—In 1937, Elvehjem demonstrated that nicotinic acid, a chemical known for over seventy-five years, when fed to dogs resulted in a prompt cure of the disease known as black tongue. This disease has long been known to bear some relationship to pellagra in humans. In November, 1937, Spies and others produced dramatic results by feeding this substance to pellagrins. The skin lesions, stomatitis, gastrointestinal symptoms, and mental symptoms disappeared almost overnight.

Vitamin B_6.—This vitamin was demonstrated in 1933, a lack of it producing dermatitis in rats. It was not until June, 1939, however, that Spies reported the remarkable effect of the administration of pure synthetic B_6 to certain patients suffering from extreme nervousness, insomnia, irritability, abdominal pain, weakness, and difficulty in walking. This vitamin is found in many foods such as wheat germ, egg yolk, lard, soy bean, flaxseed, peanuts, and in some fruits and vegetables.

The chemical formulae of these four vitamins, all members of the vitamin B group, are not only known, but each has been synthesized in the laboratory.

Vitamin C.—A lack of vitamin C results in the development of the disease scurvy, which is characterized by an increased permeability of all the capillaries of the body. In infants the disease usually appears between 6 and 12 months of age and is characterized by the infant crying on being picked up, swellings appearing at the ends of the long bones of the legs, due to subperiosteal hemorrhages, and hemorrhages at the junction of the teeth and gums, if the teeth have erupted. Recent work indicates that this vitamin should be administered to infants, starting shortly after birth, in the form of 1 to 2 ounces of orange juice daily. This vitamin is present in most raw fruits and vegetables, but is readily destroyed by cooking; hence the need for everyone to take each day some raw fruit or raw vegetable salad.

Vitamin D.—A lack of vitamin D results in the development of rickets. It is not generally recognized that there is practically no vitamin D in the foods ordinarily consumed. Our chief sources of this vitamin are the antirachitic effect of summer sunshine, and fish liver oils or viosterol. Vitamin D should

be given to every infant shortly after birth, in the form of 1 or 2 teaspoons of cod liver oil daily, or 5 drops of the more potent fish liver oils, such as oleum percomorphum, or 5 drops of viosterol.

Vitamin E.—Not a great deal is known about vitamin E, except it has been demonstrated that in humans the administration of this vitamin to women with a tendency to abort has allowed many of them to proceed to a normal labor. Vitamin E is present in wheat germ, butter, milk, and many vegetables and fruits.

Vitamin K.—In 1935, Dam and Schönheyder described the antihemorrhagic vitamin of the chick. It was found in large amounts in alfalfa and other green foods. Recent work both here and elsewhere has shown that this vitamin is necessary for the normal formation of prothrombin, and thus is an important factor in the prevention of hemorrhages under certain conditions. It is probable that hemorrhagic disease of the newborn is due to a lack of this vitamin. Work being carried on at the Hospital for Sick Children by Dr. C. E. Snelling shows that the administration of this vitamin to pregnant women for 1 to 2 weeks before labor results in a marked reduction in the "prothrombin time" of the cord blood of the infant, and thus probable reduction in the tendency of the infant to bleeding. The possible importance of this observation on the prevention of hemorrhages in the newborn infant is obvious.

The physician's attitude towards vitamins.—A study of the food habits of the Canadian people, as shown by figures obtained from the Bureau of Statistics at Ottawa, indicates that approximately 44 per cent of the caloric intake of the Canadian people, based on an average daily intake of 3,000 calories, is practically devoid of vitamins. From this information, and also from local studies, there is considerable evidence that we as Canadians suffer from a suboptimum intake of vitamins B_1, D, and sometimes vitamin C. It should be kept in mind that any restriction in diet will probably accentuate this condition. Also, it has been shown that during the presence of an infection the need for most vitamins is markedly increased. Many physicians also overlook the fact that during pregnancy and lactation the need for most vitamins is doubled. Under ordinary conditions, if the physician sees that his patient takes a diet consisting of a pint to a pint and a half of milk a day for children, one-half pint a day for adults, some meat, an egg a day, two liberal helpings of vegetables besides potato, some raw fruit, some whole grain cereals, either in the form of brown bread or breakfast cereals, and some vitamin D during the winter months, we will be supplying all the known vitamins in adequate amounts. In addition to vitamins in foods, there are also available all the vitamins in either pure synthetic form or in concentrates obtainable through the drug stores. Under unusual conditions, such as during illness, pregnancy, lactation, and during any dietary restrictions, it may be necessary to give these vitamins in their concentrated form.

Department of Oral Surgery and Pathology

Edited by

STERLING V. MEAD AND KURT H. THOMA

Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Sterling V. Mead, 1149 Sixteenth Street Northwest, Washington, D. C. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 53 Bay State Road, Boston, Mass.

CANCER OF THE LIP

A CONSIDERATION OF ITS PROPHYLAXIS, DIAGNOSIS, AND TREATMENT

HOWARD B. HUNT, M.A., M.D., OMAHA, NEB.

CANCER of the lip is a problem worthy of careful consideration. Much can be done to prevent cancer in this area. The diagnosis can be established early. Nearly all of these lesions are curable when properly treated prior to the occurrence of metastases. Even so, two per cent of all deaths from cancer result from cancer of the lip. This indicates the possibility and need for improvement in the management of these cases. The responsibility for a successful cure or a horrible death rests primarily with the doctor who first sees the patient and directs treatment of the lesion. Temporizing delay and ineffective treatment by faulty radiotherapy, inadequate surgery or partial destruction by electric needle or caustics give a false sense of security and rob the patient of his rapidly vanishing chance for continued health and life.

ETIOLOGY AND PROPHYLAXIS

Cancer is essentially a disturbance in growth of tissues which results from both inherent and external factors. Constitutional predisposition to the development of cancer in certain regions is inherited although quite unpredictable. A family history of cancer, particularly if of the lip, skin or mouth, should make patient and doctor reduce to a minimum all extraneous factors which may precipitate the development of cancer. The patient should be instructed regarding the early signs of cancer and the doctor should be very alert in recognizing them. Cancer of the lip is almost exclusively a disease of men, being fifty times as prevalent in men as in women.

Many extraneous factors hasten the development of cancer of the lip in the susceptible individual. Sunburn should be avoided. Repeated blistering of the lip and skin by sunlight or ultraviolet is definitely injurious and probably accounts for the unusually high incidence of cancer of the face in the farming population of the middlewest. The overwhelming predilection of cancer for the lower lip, occurring on lower lip in men in 98 per cent of the cases, is in keeping with the relatively greater exposure of the lower lip to sunlight

From the Tumor Clinic and Department of Radiology, University of Nebraska College of Medicine and Nebraska Methodist Episcopal Hospital.

Reprinted from *The Nebraska State Medical Journal*, April and May, 25: 133 and 187, Nos. 4 and 5, 1940.

and other disturbing influences. The face and lips should be protected against excessive sunlight by a proper hat and application of petrolatum or aquaphor to the skin and lips by the out-of-door worker. Burns by heat should be avoided. In our experience, cancer of the lip occurred directly in a burn from short cigarettes inflicted while in alcoholic stupor in one patient and in a burn from a red-hot coal cinder in another case. Overly hot foods are inadvisable. The hot-smoking, short stemmed clay pipe has been a factor in only one of our cases (see Fig. 3). The smoking of tobacco does not in itself appear to precipitate cancer of the lip. The use of tobacco should be stopped in the presence of leucoplakia and curtailed in case of curable cancer. Snuff is a definite cause of cancer in the mouth and should never be used. Mechanical irritation of the lip should be minimized. Overhanging, sharp, irregular upper incisor or cuspid teeth should be extracted or repaired and the sharp edges ground back by the dentist. Chapping and cracking of lips can be lessened by protection against wind, weather, and sun by a thick bland ointment which can be applied repeatedly by the outside worker from a collapsible tube.

All chronic lesions showing continued overgrowth of tissues are eventually precancerous lesions and should be eliminated. Leucoplakia should be eradicated particularly in case of ulceration or extension. Magnesium sulphate, one-half teaspoonful daily in a glass of water, leads to spontaneous disappearance in some cases. Destruction of leucoplakia can be accomplished by proper fulguration, surgical dissection and plastic repair or in selected cases by caustic doses of low voltage x-ray. A papilloma or keratotic horn should be treated as a carcinoma of low grade of malignancy.

DIFFERENTIAL DIAGNOSIS

Any progressive or persistent "sore," "fever blister," "crack," or "lump" on the lower lip must be considered cancer until proved otherwise. The chancre or primary lesion of syphilis occasionally simulates carcinoma, but it can be definitely differentiated by dark field examination, biopsy, and response to antiluetic therapy. The chancre usually occurs in a younger person, is relatively much more common on the upper lip, and shows more early submaxillary adenopathy. We had one patient with cancer of lip at 24 years of age. Herpetic lesions are characterized by transient, itching, tender, crusted vesicles on an erythematous base which disappear after seven to ten days. Fissures and cracks should heal within seven to ten days also. Hemangiomatous granulomas appear as small infected papillomatous lesions, with a vascular hemorrhagic base surrounded by a zone of inflammation. Angiomas are bluish compressible submucous tumors and often are associated with a history of preceding injury. Mucous cysts are semi-translucent, submucous, encapsulated elastic bodies along the inside of the lower lip. Moles, nevi, melanomas frequently occur in the skin adjacent to the vermilion border but do not arise in the mucous membrane of the lip. Squamous and basal cell carcinoma arising in this adjacent skin may secondarily invade the lip. An area of leucoplakia which shows ulceration and extension is essentially a carcinoma. Furthermore, the adjacent mucosa will probably also develop leuco-

plakia which may subsequently go on to cancer. A papilloma is likewise a precancerous or cancerous lesion and should be so regarded. Accurate recognition of persistent or recurrent carcinoma in a treated area may be difficult. A keloid in an operative wound or an ulcer following radiotherapy may closely simulate carcinoma.

Any inflammatory lesion of the lips which does not heal in three weeks under treatment demands biopsy. Biopsy is of value in establishing the diagnosis of squamous cell carcinoma and in grading the malignancy of the growth. Subsequent scarring of tissue from biopsy can be minimized by removal of a small piece of tissue from the posterior margin of the lesion. Removal is best accomplished by a scalpel, iris scissors or a sharp basket punch. Electrosurgical procedures sear the outer cells and require a larger piece of tissue. The appeal of electrosurgery for biopsy lies in the bloodless field. In case the lesion has the clinical appearance of carcinoma and the report on biopsy is negative, a further biopsy and re-evaluation of the case are indicated. Secondary inflammation in an ulcerated necrotic carcinoma may confuse the histologic appearance and lead the pathologist to interpret the process as entirely inflammatory.

GRADE OF MALIGNANCY AND EXTENT OF CANCER

The rate of growth, probability of early metastases, and radiosensitivity of a cancer can be largely apprehended by the history, gross appearance, and histology of the lesion. Histologic appearance permits grading of tumors into four groups according to degree of malignancy. Grade 1 represents the slowly growing, well-differentiated, relatively benign tumor. Grade 4 represents the rapidly growing, highly mitotic, anaplastic, extremely highly malignant tumor. Grades 2 and 3 represent the intermediate grades of malignancy. Broders found the following distribution in 537 cases of cancer of the lip: Grade 1, 16 per cent; Grade 2, 62 per cent; Grade 3, 21 per cent; Grade 4, 1 per cent. In general, the small indolent lesions are Grade 1, the large tumors are usually Grades 2 and 3. Grade 4 is rare in the lip and usually produces early metastases to the submental, submaxillary, and cervical lymphatics.

The size and extent of any carcinoma can be roughly indicated by placing it in stage 1, 2, 3 or 4. Stage 1 represents the purely local lesions less than 2 cm. in size. Stage 2 represents the lesions with probable extension evidenced by destructive invasion of adjacent tissues or enlargement without fixation of regional lymph nodes. Stage 3 comprises the lesions with definite metastases to regional nodes or destructive invasion of adjacent anatomic structures. Stage 4 represents the far advanced, hopeless lesions with metastases beyond the regional lymph nodes or irreparable local destruction which preclude any possibility of cure by surgery or radiotherapy. The following chart allows a representative comparison of the stages of cancer of the lip as encountered in dispensary and in private practice.

The dispensary group is definitely more advanced and has a correspondingly worse prognosis. The outcome of adequate treatment depends primarily on the stage of the disease when therapy was initiated.

	UNIVERSITY HOSPITAL	PRIVATE PATIENTS
Precancerous	7	6
Stage I	40	12
Stage II	38	1
Stage III	20	1
Stage IV	3	1

TREATMENT OF PRIMARY LESION

The treatment of cancer of the lip can be considered under three divisions: prophylaxis, eradication of primary lesion, and removal or destruction of metastases. Instruction of the patient regarding prophylactic precautions and early apprehension of recurrent lesions, new cancers, or metastases is an essential part of treatment. Measures for reduction of carcinogenic influences have been outlined already.

The local lesion in carcinoma of the lip can be eradicated by a variety of methods providing the procedure is correctly performed. Surgical excision offers prompt evidence of elimination of the cancer. It is therefore favored by clinics which draw patients from long distances and must show dramatic evidence of a cure upon dismissal of the patient. Surgical excision is a safer procedure in inexperienced hands than radiotherapy. Electrosurgery has no advantage over scalpel surgery except easier hemostasis, and it has the disadvantages of slower healing and more scarring. Use of the "electric needle" is too frequently followed by recurrence to allow recommendation of fulguration or coagulation. The unfavorable complaints met after surgery are local recurrence following incomplete removal and difficulties related to imperfect plastic repair. Patients are occasionally displeased by the cosmetic result and their occasional inability to retain liquids in the mouth. A few patients do have some unfounded antagonism against surgery. The adequacy of proper surgical excision for controlling cancer of the lip has long been established.

Correctly administered x-ray and radium therapy are as effective as proper surgery in controlling the primary lesion in cancer of the lip or skin. The first series of x-ray or radium treatments must be correctly applied if success is to be attained. The lesion will never respond as well to subsequent irradiation of equal intensity. This loss of radiosensitivity is due to impaired blood supply and fibrosis through the tumor bed. Radiotherapy usually gives a better cosmetic result than surgery and gives better preservation of function particularly in the large papillary tumors (Figs. 2, 4, 5, and 6). In our experience, subsequent plastic repair is very rarely indicated following control of the cancer by moderate radiotherapy. X-ray and radium give essentially the same biologic effect and differ primarily in distribution of intensities. X-ray provides an even, homogeneous irradiation of controlled penetrability. Radium provides an intense local effect which can be concentrated superficially by a plaque or subcutaneously by needles. When using radium, the tongue and upper lip must be packed away from it. In radiotherapy, it is essential to treat 5 mm. beyond the visible border of the lesion and deliver seven to ten erythema doses in three to twenty days depending on the size of the tumor.

The choice of therapeutic agent will depend on the gross morphology of the lesion, history of previous attempts at treatment, the grade of the malignancy, the antipathies of the patient, and the experience of the therapist. The small superficial lesions are treated by low voltage x-ray (Fig. 2) or radium plaque (Fig. 1). The infiltrating cancers are treated by intermediate voltage x-ray supplemented by interstitial radium in the deeper lesions (Fig. 3). The large papillary tumors are treated by intermediate or high voltage, lightly filtered x-ray supplemented by interstitial radium through the base of the tumor (Figs. 4 and 6). Occasionally the pendulous portion of the large tumor (Fig. 5) is ablated to expose the base, but this is not necessary. In the ulcerating destructive lesion with extensive sloughing away of the lip, we prefer immediate wide surgical excision followed directly by plastic repair. Local invasion of bone is treated by electrocoagulation with or without local excision. In persistent or recurrent carcinoma of the lip encountered after inadequate radiotherapy, we ordinarily advise surgical resection in view of acquired radioresistance. A radiation ulcer which persists after four months is best resected and repaired by a plasty. Recurrent lesions encountered after surgical resection are usually treated by interstitial radium therapy.

TREATMENT OF METASTASES

Metastases from cancer of the lip occur first in the submaxillary and submental nodes in nearly all cases. It is exceedingly rare that metastases are evident in the cervical nodes without gross involvement of the structures in the suprahyoid triangles.

Distribution of metastases in 537 cases of cancer of the lip was analyzed by Broders. Nodes were resected in 87 per cent and metastases found in 23 per cent of cases thus resected as follows:

Submaxillary nodes		88%
Submental nodes		25%
Submaxillary gland		22%
Cervical nodes		25%
Ext. jugular	63%	
Ant. cervical	21%	
Super. deep cerv.	8%	
Infer. deep cerv.	8%	
Mandible		6%
Liver		1%
Lung		1%

Cancers arising at the corners of the mouth tend to metastasize unusually early. Enlargement of lymph nodes suggests metastases but frequently is due to inflammation secondary to ulceration and infection in the cancer on the lip. In our experience, metastases are present in about 25 per cent of patients with palpably enlarged but movable nodes. About 10 per cent of patients showing no initial adenopathy will subsequently develop metastases according to Duffy.

The treatment of metastases from cancer of the lip is an individual problem. The added prospects of cure must be balanced against the losses from

A. *B.*

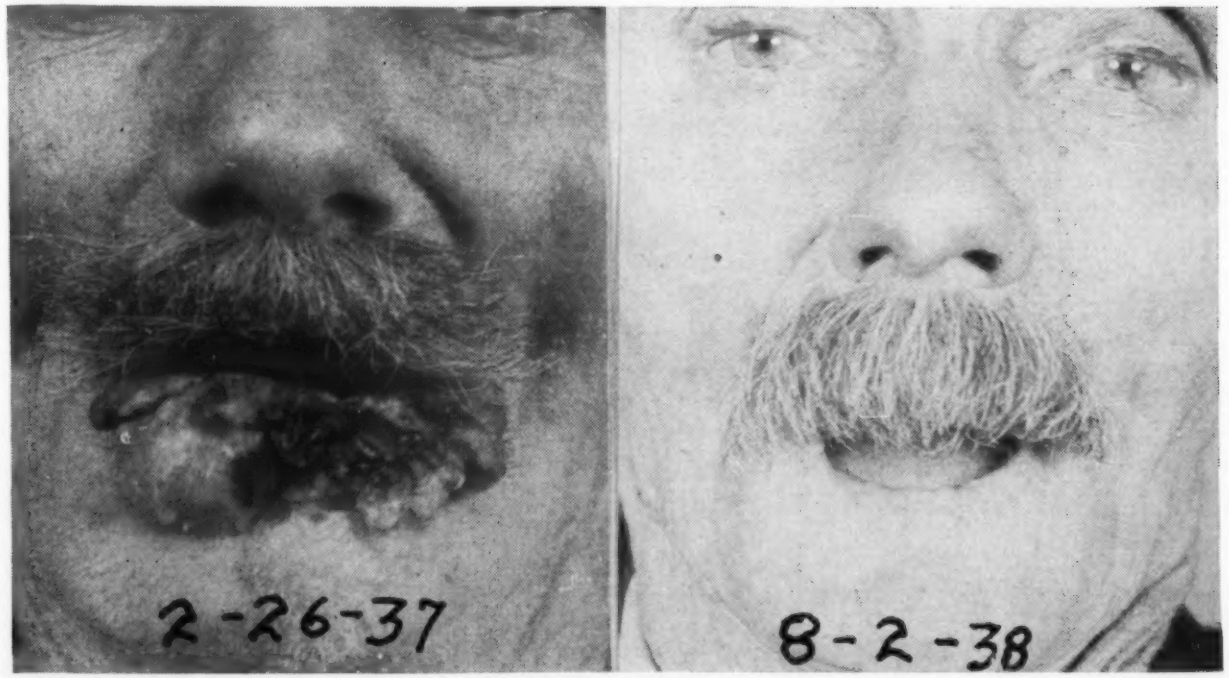
Fig. 1.—*A*, G. L., 39946. Age 46. Farmer. "Cold sore" for five months, proved squamous cell carcinoma by biopsy. Treated by radium plaque to the lip and intermediate x-ray therapy over regional nodes. *B*, G. L. No evidence of cancer and only slight scarring. He remains well after seven years and has never shown recurrence or metastasis.

A. *B.*

Fig. 2.—*A*, C. S., D71416. Age 38. Papillary carcinoma of Grade 1 to 2 malignancy developing in a cigarette burn one year previously, note also jagged overhanging incisor. *B*, C. S. Cancer has been eradicated leaving no scar three months after local x-ray therapy. No recurrence or metastasis after three years.

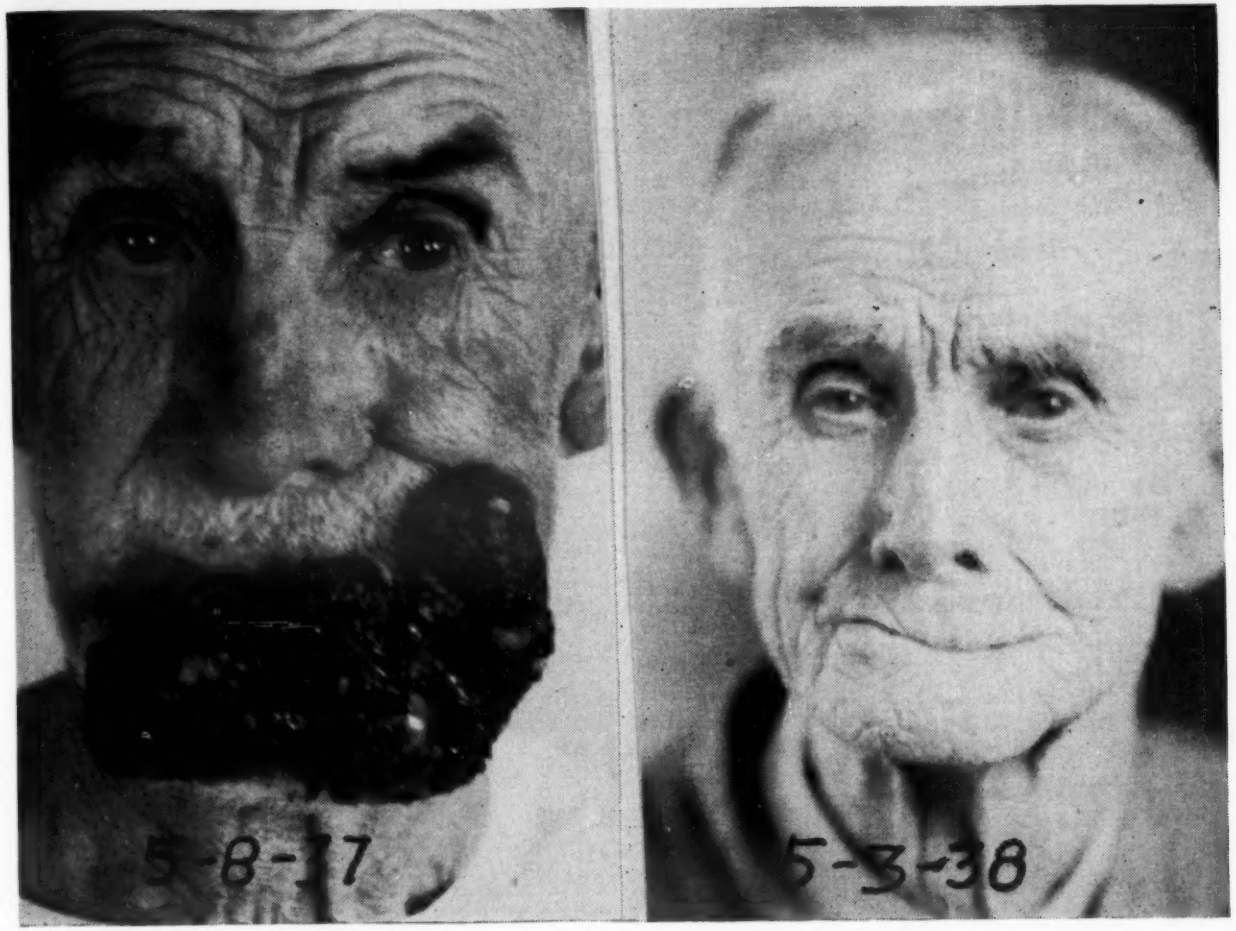
A. *B.*

Fig. 3.—*A*, A. L., 52702. Age 48. Carcinoma developing on lower lip where pipe was held for many years (note imprint of pipe stem on teeth); *B*, A. L. Cancer controlled by interstitial radium in local lesion and deep x-ray therapy over regional nodes. Remains well after four years.



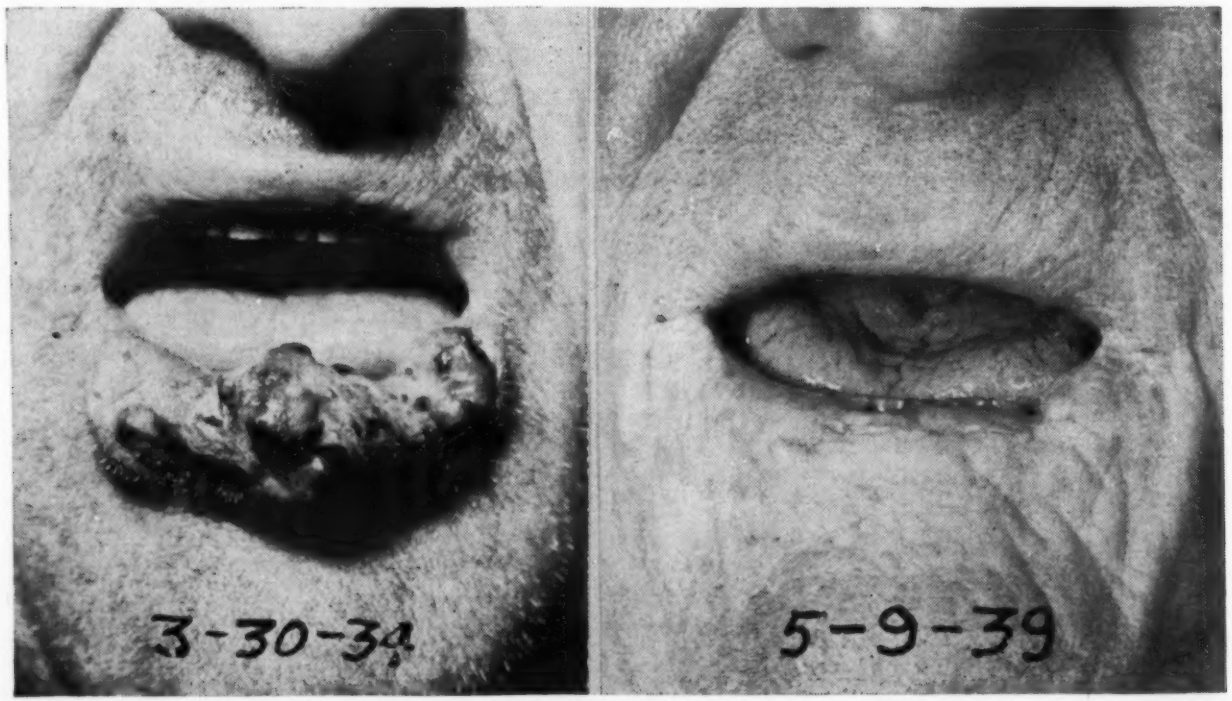
A. *B.*

Fig. 4.—*A*, P. K., 56276. Age 68. "Fever blister" developing into a tumor covering entire lower lip, Grade 2 squamous cell carcinoma. Lip treated by deep x-ray and interstitial radium with deep x-ray therapy over regional nodes. *B*, P. K. Cancer completely disappeared and no plastic repair was necessary. He is well after three years.



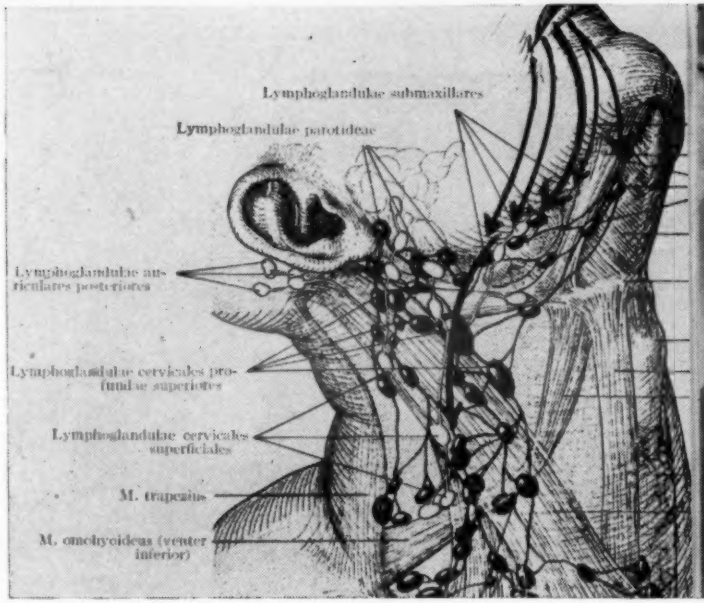
A. *B.*

Fig. 5.—*A*, G. S., 56944. Age 80. Rapidly developing papillary carcinoma, Grade 3, involving entire lower lip. Lesion treated by ablation, deep x-ray and interstitial radium, deep x-ray to nodes. *B*, G. S. Complete eradication of cancer with no evident metastases. No plastic repair indicated. Died suddenly on December 12, 1938, from "heart attack."



A. *B.*

Fig. 6.—*A*, J. P., Rr. 5055. Age 65. Extensive Grade 3 to 4 cancer of the entire lower lip, recurrent three years following inadequate x-ray therapy. Lip treated by radium in surface mold and interstitial needles, x-ray therapy over nodes. *B*, Control of cancer with good preservation of lip and no metastases after five years.



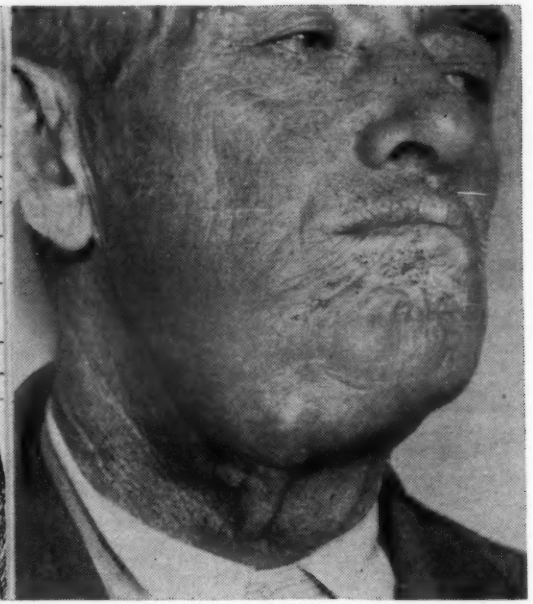


Fig. 7. Fig. 8.

Fig. 7.—Surface anatomy of the lateral region of the neck showing distribution of lymph nodes and routes of metastases from the lip (adapted from Callander).

Fig. 8.—Systematic follow-up is essential. Cancer on lip cured locally three years ago. Patient noted enlarging lumps below jaw after two years, but he neglected to again see physician until one year later when metastases were uncontrollable.

operative mortality, distress, and mutilation by the procedures. Broders reports five-year cures after thorough surgical resection to be as follows in relation to metastases:

	FIVE-YEAR SURVIVALS
Cancer of lip without metastases	90 %
Submaxillary node on one side	33⅓%
Bilateral submaxillary or cervical nodes	1 %

A suprahyoid dissection with removal of lymph nodes and submaxillary salivary glands carries a negligible mortality and yields cures in about one-third of the earliest metastases, making the procedure well worth while in selected cases. A block dissection with removal of all lymphatics and adjacent connective tissues from the mandible down to the clavicle carries a mortality of 5 per cent and yields not over 1 per cent five-year survivals. Therefore, surgical resection of nodes is not warranted when there is definite evidence of metastases below the hyoid.

X-ray and radium therapy are of value in retarding extension of metastases, in decreasing the size of metastatic masses, and in sterilizing metastatic nodes in selected cases. Deep x-ray therapy alone will produce fibrosis along the lymphatics thereby hampering the establishment and spread of metastases. The percentage of cases showing metastases subsequent to control of local lesion is reduced about one-half by prophylactic deep x-ray therapy according to Widmann. The destruction by radiotherapy of metastases established in lymph nodes from cancer of the lip usually requires a combination of deep x-ray therapy and interstitial radium.

The treatment of metastases will be considered according to the stage and grade of the lesion. The (Grade 1, stage 1) very slowly growing, small, well-localized cancer requires treatment of only the primary lesion. The (Grades 2 and 3, stage 1) moderately malignant, apparently localized lesion justifies prophylactic deep x-ray therapy and monthly follow-up by the local physician for evidence of metastases. Dissection of lymph nodes from the suprahyoid region of the same side is justified in case metastases are probable and when follow-up is impractical. The rare (Grade 4) extremely highly malignant carcinoma of the lip should be treated entirely by radiotherapy including the local lesion and submaxillary and cervical nodes regardless of the apparent stage (Fig. 6).

Lesions over 2 cm. in size or those associated with masses in the submaxillary or submental regions (stage 2 and early 3) advise suprahyoid dissection and removal of lymph nodes, submaxillary glands, and adjacent connective tissues. In case the mass is adherent over bone, the periosteum should be removed and the adjacent bone fulgurated. Unexpected areas of deep soft tissue invasion warrant local implantation of radium needles at the time of operation. Metastatic lesions which are bilateral and fixed (stage 3 are better treated by deep x-ray therapy fortified with interstitial radium although not over 5 to 10 per cent of these lesions can be controlled. The far advanced (stage 4) lesions are treated palliatively by drugs to relieve pain, by small

to moderate doses of deep x-ray therapy to shrink masses and lessen infection. Ligation of the external carotid is occasionally done to control bleeding. Death may result from inability to swallow, bronchopneumonia, sepsis and cachexia, or a merciful hemorrhage.

SUMMARY

1. Any "crack," "fever blister," or unexplained "sore," especially if on the lower lip of a man, which does not heal within four weeks, must be considered cancer until proved otherwise by biopsy or dark-field examination. Cancer and syphilis can coexist.

2. The incidence of cancer of the lip can be reduced by (a) protection against sunburn, (b) avoidance of burns by short cigarettes, hot pipes, etc., (c) relief from irritation by sharp, jagged or overhanging teeth, and (d) eradication of leucoplakia and papillomas.

3. The primary lesion of cancer on the lip can be controlled by radiotherapy or surgery. Radiotherapy is generally preferred by us due to its simplicity, a better cosmetic result, and less interference with function. Resection and plastic repair are advised for the ulcerating, destructive cancer and the rare radioresistant lesion.

Systematic follow-up is an essential part of proper care.

4. Metastasis occurs first to the submaxillary and submental lymph nodes and submaxillary salivary glands, with later extension to the cervical nodes, mandible, and adjacent structures.

5. The treatment of metastases is an individual problem. The indicated management depends primarily on the stage and secondarily on the grade of the cancer as detailed in the paper.

6. The prospects of a "five-year cure" are 90 to 95 per cent without apparent metastases, 33⅓ per cent with an early single focus of metastasis in the suprahyoid structures and only 1 per cent after metastases are present in the cervical lymph nodes. The importance of early correct diagnosis and adequate treatment is obvious.

REFERENCES

1. Broders, A. C.: Squamous-Cell Epithelioma of the Lip, J. A. M. A. **74**: 656, 1920.
2. Duffy, J. J.: Cervical Lymph Nodes in Intraoral Carcinoma; Surgery or Irradiation, Am. J. Roentgenol. & Rad. Therapy. **39**: 767, 1938.
3. Widmann, B. P.: Carcinoma of the Lip, Results of Roentgen and Radium Treatment, Am. J. Roentgenol. & Rad. Therapy. **32**: 211, 1934.

ORAL SURGICAL CONDITIONS AND THEIR TREATMENT

JOSEPH A. DOHERTY, D.M.D., B.S., M.S., BOSTON, MASS.

THE oral cavity is the site of many pathologic conditions, the diagnosis and treatment of which present fascinating problems. The belief that the teeth might serve as a source of systemic disease was substantiated by the researches of Billings of Chicago and later Rosenow of the Mayo Clinic. The subject of focal infection was brought most forcibly to the attention of both dental and medical professions in 1910 by Sir William Hunter in his epoch-making address at McGill University, Montreal, Canada. As a consequence, a newer conception of the relationship of dental infection to general health was fashioned in the minds of the professions and laity alike, to the end that gradually dentistry assumed its medical aspect and became an important branch of the healing art.

The care of the mouth preliminary to surgery is not always given the importance it deserves. Stricter attention to this particular tends to prevent unsatisfactory end results and to reduce postoperative treatment. The presence of Vincent's infection contraindicates any type of surgical intervention. This disease, the etiology of which though not entirely known, is believed to result in part from the combined activity of two anaerobic organisms which localize in the interproximal spaces and under gum flaps. Treatment in most instances may be successfully carried out by the judicious use of oxygen-containing medicaments, such as hydrogen peroxide and sodium perborate.

As a general rule, the removal of a large number of teeth at one time is not a wise procedure. It is not rare that a patient is afflicted with some general disease, such as diabetes, of which he is unaware. In the case of arthritic patients, the extraction of one or more teeth at the first appointment provides the opportunity to observe the reaction therefrom. The resulting increase of antibodies rends to elevate the individual's resistance and render subsequent surgery less shock-producing.

If a fractured apex is not removable in the usual manner then it is preferable to reflect the mucous membrane, detach the buccal plate of bone and thereby obtain direct access to the fragment. In extracting the maxillary molar and premolar teeth, it is possible that an artificial opening may occur or that a root tip may be dislodged into the maxillary sinus. The apex should always be removed as infection of the sinus invariably follows. Access to the antrum can be obtained either by enlarging the socket or by creating an approach through the canine fossa. If an antral-alveolar opening remains after

Read, supplemented with lantern slides, before the New Brunswick Dental Society at the Forty-Fifth Annual Convention held at the Admiral Beatty Hotel, St. John, N. B., Canada, July 8 and 9, 1940.

a tooth has been extracted, the blood clot should be allowed to form in the socket; protecting it from the mouth fluids will aid in its organization.

Dry socket is a condition which the practitioner encounters occasionally. The usual picture is the absence of a blood clot, the bony wall of the alveolus being exposed to the oral secretions. The common symptom is severe pain. Much is yet unknown concerning the cause of this painful sequela. Some years ago a study of the condition was made in one of the large dental clinics in the United States in the belief that possibly it was associated with the physical state of the patient. No such relationship was established. It was noted, however, that dry sockets occurred in those areas, namely the premolar and molar regions of both jaws, where the greatest amount of suction was obtained. If one were to theorize as to one of the probable causes, the conclusion might reasonably be reached that dense bony alveoli, encompassing teeth with thin periodontal membranes, did not permit sufficient effusion of blood into the socket to form the necessary network for future bony growth. Dry socket seems to follow where much difficulty and trauma are associated with the removal of teeth, particularly when the latter are devitalized. It is known that a spreading infection from such a condition is improbable if conservatively treated. Control of pain is the main consideration. Any loose spicules of bone should be removed. A cautious irrigation of the wound plus local and general medication is a fairly well-accepted procedure. The insertion in the socket of one of the proprietary dressings will, in most cases, give relief.

Two types of cystic lesions commonly are found in the jaws, both originating from the teeth. The radicular cyst always grows about the root end of a devitalized tooth, while the follicular or dentigerous type develops about the crown of an unerupted tooth. Though infected infrequently, they may through gradual enlargement encroach upon the mandibular canal or the maxillary sinus with partial obliteration of either structure. Small cysts may be treated by enucleation while the larger ones are best managed by the more conservative open or Partsch method.

In diagnosing pain about the face elimination of the teeth as a possible source should always be primary. The advent of the x-ray with its capacity for providing contrasting densities of the teeth and bone, added a valuable diagnostic aid to clinical findings. It is not uncommon to find pain radiating over the side of the neck, around or within the ear, and throughout the various facial regions, the cause of which may be traced to the teeth. The mastery of the fifth nerve by regional anesthesia has aided in the study of nerve disturbances about the head. Trigeminal neuralgia, or, as sometimes referred to, tic douloureux, is characterized by definite symptoms. The pain comes like a flash of lightning, lasts but a few seconds, and always returns to a certain spot known as a trigger zone. The pathetic figure presented by the patient gravely affected by this malady is one not easily erased from the mind. The most conservative treatment is the use of alcoholic injections which provide relief for about a year's duration.

It is a debatable question whether or not a tooth should be removed in the presence of an acute infection. The dentists of the old school believed that the infection should be localized before any teeth were disturbed. It would appear from the innumerable postoperative complications following surgical procedures during an acute inflammatory stage, that this is a sane and practical way to approach the problem. However, if the infection is confined solely to the tooth and has not penetrated the surrounding bone, the extraction is indicated.

When hemorrhage occurs the mouth should first be cleared of blood clots and irrigated; the exact source of the bleeding should be noted. Various remedies may be applied; the simplest is to pack the socket with a small adrenalin-soaked piece of gauze. The suturing together of the buccal and lingual flaps of mucous membrane will invariably produce sufficient pressure to alleviate this troublesome condition.

The mandible in particular appears to have a predilection for osteomyelitis. Surgical intervention during the fulminating period, except for the purpose of evacuating free pus, has always been condemned by those who have had extensive experience in treating this disease. Curettage of the jaw breaks down the natural peripheral barrier which Nature has devised and, not only permits dissemination of infection, but interferes with the regeneration of bone. It is advisable that sequestra be left undisturbed until definitely separated from live bone.

The rational therapeutic use of heat and cold is a most controversial topic. There is no better guide to its indications than the experience which results from clinical observations. Greater familiarity with the highly complex defensive process of inflammation should aid materially in the intelligent use of thermal agents. Inflammation is viewed as the logical reaction of vital tissue to irritation; the common irritating factors are trauma and infection. Inflammation is no longer considered an evil but a protective process. It has for its object the overcoming of infection and the bringing of more blood to the part with a pouring out of its elements upon the injured tissues, thus surrounding the invading forces. Cold, it appears, is best used in inflammation due to trauma; its use tends to constrict the blood vessels and to lessen the inflammatory process. Inflammation resulting from infection should be treated by heat which stimulates the circulation, promotes comfort, and allays pain. Increased blood supply to the tissues is interpreted as meaning increased resistance of the individual.

The choice of anesthetic is an important matter. The perfection of the technique of block anesthesia has given to the dental profession a practical and efficient method of eliminating pain. Besides, the improvement during late years in the composition of solutions has aided in increasing this efficiency. When the various injections have been mastered, the use of a local anesthetic has advantages in the hands of many men. However, the injection of novocain into inflamed areas is contraindicated. For these cases nitrous oxide is

the agent of choice. Many patients express a desired preference for a general anesthesia. In nitrous oxide a satisfactory agent, well adapted to office practice, is at our disposal.

These are a few of the problems that are met with in daily practice. The aim is to solve them in order that our patients may not suffer unnecessarily and that the routine of their daily lives will be affected as little as possible by our surgical procedures. In accomplishing this, we are not only contributing to human happiness but are promoting respect and admiration for our profession.

419 Boylston Street

CRANIAL OSTEOMAS

From a Roentgenologic Viewpoint

Charles Wadsworth Schwartz, M.D., New York, N. Y.

WHAT is an osteoma? The answer to this question is not as simple as it may seem. The dictionary (Standard) states that an osteoma is a bony tumor, a hard tumor of bonelike structure developing on a bone and sometimes on other structures. But it must be borne in mind that there are many forms of bone hypertrophy (tumefaction) which are not osteomas, such as the overgrowth associated with reparative reactions, from infections, invasive tumors, and other forms of irritation. Hence we shall have to be content to state that a true osteoma is a bony tumor which exhibits neoplastic characteristics, but not all bony tumors are osteomas. Ewing states that even the microscope at times fails to differentiate osteomas from simple bony hypertrophy. So we see that our original question cannot be answered satisfactorily until we learn more about the origin of these interesting tumors. Ewing describes the bony tissue forming an osteoma as ivory-like with solid lamellae and with few or no Haversian canals, or it may be spongy with cancellous tissue, or it may contain marrow cavities or spaces. Thus it can readily be seen that merely because the tumor does not appear dense in the roentgenogram, it is not necessarily an osteochondroma, but may be an osteoma with less dense spaces scattered throughout its mass. The less densely formed osteomas will usually be found arising from cartilage or bone of cartilaginous origin, while the dense tumors as a rule originate from bone of membraneous origin, from periosteum, or within the bone itself.

When osteomas occur in the skull, they will usually originate in certain sites of election. One of the most common locations for these tumors is in the fronto-ethmoidal region, and less common locations are in the middle fossa and involving the petrous pyramids.

The group of osteomas used for this review consisted of forty-eight cases, and of these 60 per cent were fronto-ethmoidal in origin divided nearly equally between an origin wholly within the frontal sinuses and an origin involving the vertical portion of the frontal bone. Thirteen per cent were found to originate in the orbito-ethmoidal region which, generally speaking, could be classed as frontal. Another 13 per cent originated in the parietal bones. Six per cent were found involving the petrous portions of the temporal bones, while tumors arising from the squamous portions of the temporal bones accounted for 4 per cent of the total number. Another 4 per cent were found in the occipital region. It might be of interest to quote here Fetissof's figures based on a total of over 200 cases, showing the distribution of osteomas in the nasal accessory sinuses. He found

Reprinted by courtesy of the *American Journal of Roentgenology* 44: 188, 1940.

50.7 per cent of the total number situated in the frontals, 26.7 per cent in the ethmoid labyrinth, 6.2 per cent in the maxillary sinuses, and 3.1 per cent in the sphenoid sinuses.

Usually osteomas will be found arising from the surface of the bone and can therefore be designated as exostotic, but not infrequently their origin will be seen to be enostotic or within the bone. Fetissof is of the opinion that an osteoma grows from within, due to a metaplasia of fibrous tissue directly into bone. It should be noted that osteomas and fibromas have many points in common, but the osteomas have true bony capsules. As a rule, the osteomas occurring in the frontal region and those involving the facial bones will be of the enostotic variety. This is likewise true of the osteoma found involving one or more of the bones forming the vault. These calvarial osteomas usually originate in the diploe and involve one or both of the adjacent tables.

The etiology of the osteomas is as obscure as the etiology of other forms of neoplasms. Arnold thinks they arise from cartilaginous or periosteal embryonal rests. He points out that their usual sites of election are where two forms of bone are joined. Fetissof presents considerable evidence to support his theory of a periosteal origin. Kretschmann suggested in 1910 that the sutures in the skull might be likened to the epiphyses in the long bones, and as many cranial osteomas occur near suture lines the similarity of origin with such tumors found elsewhere becomes obvious, but he offers no definite theory as to etiology. After considering the various theories regarding the origin of these tumors, we are forced to conclude that the answer has not yet been found. It is interesting to note that there is considerable evidence to support the theory that trauma or infection may at times stimulate an osteoma to speed up its ordinarily very slow growth. Most of the evidence, however, seems to indicate that a year or two may intervene between the trauma and any appreciable increase in size of the tumor. If an injury can actually cause such a tumor to grow, then we might go a step further and consider trauma, or any source of irritation, as a possible stimulus to the original anlage, whatever that may consist of, and so start such a tumor on its course.

A perusal of the literature elicits the interesting fact that cranial osteomas are more prevalent in males than in females. This observation is difficult to explain unless it is because more male skulls have been examined, due chiefly to the greater prevalence of trauma to men. Most osteomas originate in young people and rarely do we find such tumors beginning in persons past middle life.

Intracranial and especially frontal osteomas are not infrequently associated with mucoceles. This is a condition which was most interestingly and dramatically described and discussed by Cushing. When such an association occurs, the growth is apt to extend intracranially far enough to puncture a lateral ventricle, and the only known way to stop such progress is by operation. If a ventricle is invaded in such a manner we will usually find that an autopneumo-encephalogram has been produced which may outline the extent of the invasion. Occasionally a tumor may break through the inner wall of the frontal or ethmoidal sinuses and so permit air to reach the subdural or sub-

arachnoidal spaces, and cases have been reported where the cerebral substance was invaded so that a pneumatocele was produced, which might be termed a pneumo-encephalocyst. Osteomas may invade the orbits, neither orbit being more prone to involvement than the other, but when an orbit is involved there is usually some exophthalmos of a nonpulsating type, and not infrequently the patient will complain of double vision, with or without an actual displacement of the eyeball, usually downward and outward if present. Such orbital tumors are chiefly ethmoidal in origin and occasionally they will be pedunculated. The orbito-ethmoidal tumors may at times extend backward and appear in the roentgenogram in a manner strongly simulating an olfactory groove meningioma, and such a finding may be so striking as to make a differentiation very difficult. Usually, however, in good stereoscopic films it will be possible to trace the bony growth to the inner orbito-ethmoidal region, and as Cushing has pointed out, most meningiomas, with which such a tumor might be confused, originate from the outer third of the sphenoid ridge, hence a differentiation is usually possible. It would be well to have the history of the case, and if possible, the clinical findings readily available when attempting to evaluate such changes seen in the roentgenogram. Usually the symptoms would be of greater severity in the presence of an olfactory groove meningioma than with a relatively small osteoma.

Fig. 1.—A flat osteoma of the left temporal bone.

A few authors writing on the subject of cranial osteomas seem to feel that all such tumors are progressive, and unless surgically treated the prognosis will invariably be poor. Cumston, however, has had the opportunity to check up on cases which have harbored such tumors for many years, one as long as forty-two years, without showing serious complications. Certainly a fairly large proportion of the osteomas we find incidentally in an examination for other suspected pathology are growing at an extremely slow rate, if at all.

Such a tumor, however, must always be considered as a potential source of trouble, particularly if the patient harboring it should be subjected to trauma which may stimulate its propensities for growth. The endocrine status of the patient may influence the tendency of the tumor to grow. A case with hyperpituitary tendencies might well be checked up more frequently than one not so constituted.

Many cranial osteomas are asymptomatic. This is particularly true of the tumors found in the frontal sinuses. If they are too small to produce pressure on adjacent sinus walls or block a sinus outlet or produce pressure on a sensory nerve, their discovery would be purely accidental and incidental. The osteomas involving the outer walls of the frontal sinuses are less apt to become of clinical importance than those situated elsewhere. If we discover the presence of an asymptomatic osteoma it would be wise to re-examine the patient at least every six or eight months in order to check on the size of the tumor. If it shows any increase in size, it should be removed. It might not be out of place to mention in connection with such comparative examinations that the technique employed in obtaining the films must be closely comparable. This can be checked by measuring the overall diameters of the skull in the two sets of films, and if any appreciable variation exists, a proportionate variation must be allowed when measuring the size of the tumor shadows. Such allowances would compensate for variations in target film distances, but presupposes similar positioning and closely similar film densities. Many mistakes have been made, and are still being made, by attempts to compare noncomparable sets of films. If the tumor shows signs of enlarging, it certainly should be removed. It might be of interest to note here that in 1864 an attempt was made to remove an osteoma from a patient in the Massachusetts General Hospital of Boston. If this was not the first, then it must have been nearly the first such attempt to be made in this country.

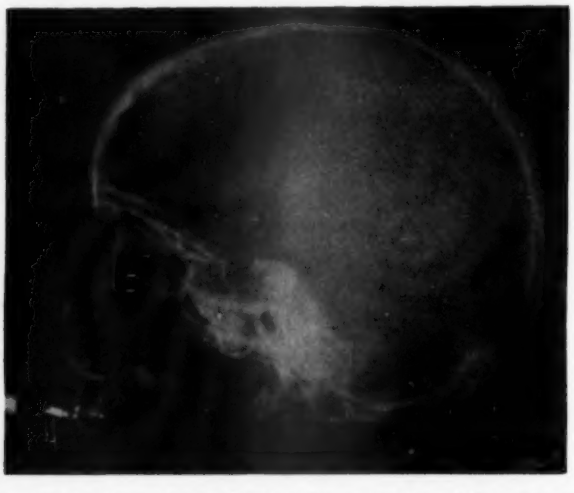


Fig. 2.—A small osteoma situated near the outer tip of the petrous pyramid.

When considering the interval which might safely be allowed to elapse between check-up examinations, it should be borne in mind that osteomas are apt to grow more rapidly in young people and that the spongious type of tumor will enlarge more rapidly than one composed of dense sclerosing bone. Inci-

dentally, the sclerosing type of tumor may be broken off surgically, or may even slough off, and it is not likely to recur, but, on the other hand, a successful removal of a spongious osteoma necessitates a careful and complete removal of the tumor together with some of the adjacent and underlying normal bone.

There are several conditions occasionally encountered in examination of skulls which are somewhat difficult to classify without reservations as true osteomas. The first of these conditions that we will discuss is an hypertrophy of bone occurring at the intermaxillary and palatomaxillary suture. Such a bony overgrowth is known as a torus palatinus.

This interesting anomaly is usually in the form of two bony nubbins situated one on either side of the suture. Frequently these nubbins are very small, or they may reach a diameter of several millimeters. Their discovery, as a rule, is incidental, and by some they are considered as familial or even racial characteristics. The races inhabiting the temperate and torrid zones are more apt to possess such bony tubercles than those living in the more rugged climes. But interestingly enough, people living in the northern countries occasionally exhibit a somewhat similar pair of bony knobs known as torus mandibularis. These are found at about the level of the second premolar teeth and about 1 cm. from the alveolar margin. Occasionally both a torus palatinus and mandibularis will occur in the same individual.

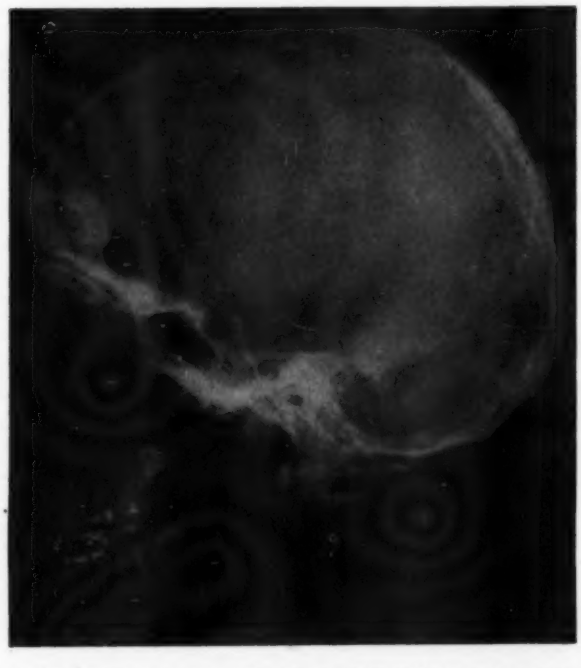


Fig. 3.—An osteoma of the frontal bone. The frontoethmoidal region is a common site of election for these tumors.

The torus palatinus and torus mandibularis are evidently genetic in origin and therefore not osteomas, but on rare occasions we will find these nodules enlarged, particularly the torus palatinus. It is under such circumstances that we might be justified in considering the possibility of the presence of a superimposed osteoma. This is especially true if we find a concomitant bony

tumefaction extending along the intermaxillary suture. It is undoubtedly true that histologically these bony tumors are indistinguishable from the osteomas, but etiologically they are evidently congenital in origin and therefore their growth, if any, is to be explained on some as yet rather obscure endocrine basis.

There would be no great importance attached to the finding of either form of torus or bony hypertrophy along the intermaxillary suture, unless the hypertrophy could be demonstrated to be enlarging, or by its presence the overlying soft tissues were being subjected to an abnormal amount of trauma, or that there might be some interference with contemplated maneuvers of a dental surgeon.

Occasionally we find plaques of calcification in the meninges which have progressed to actual ossification in whole or in part. Such ossification might well be classified as at least osteomatoid, if not as a true osteoma. They are evidently formed by a metaplasia of fibrous tissue directly into bone. Such osteoidomas are not infrequently found in the falx cerebri, and they are usually roughly triangular in shape with the base in the falx. In well-made films of sufficient density to show bone detail, such deposits can usually be differentiated from the more commonly found calcific deposits. These osteoidomas of the falx are supposed to be asymptomatic, but when one attains a considerable size it seems highly probable that it may become at least a potential source of irritation to the adjacent surfaces of the cerebral hemispheres.

Fig. 4.—An osteoma of the petrous portion of the temporal bone. It is of the combined dense and spongy type.

The dura may be found to be involved in a bony metamorphosis. When such a condition is recognized its status should be checked every few months, and if it is seen to be enlarging with any rapidity, one would be justified in suspecting the presence of either an osteoblastic or an "en plaque" type of meningioma, even though the overlying inner table of the calvarium be unin-

volved. Any enlarging tumor mass, whether due to a simple fibro-osseous metaplasia or to something else such as a meningioma, should receive careful surgical consideration, because in either case the tumor becomes simply an accident awaiting the opportunity to happen.

Ossification occasionally will be found in the presence of an old hematoma. Such ossification will usually be quite irregular, and in addition will be complicated by irregular deposits of calcium which would be predominant. In good stereoscopic films the entire involved area will be seen to be very irregular in outline and thickness. The calcium and osteoid deposits will not be confined to the meninges but will be seen scattered throughout the mass. If the hematoma be of the "en plaque" type then the deposits will appear to be in one plane, but the extreme irregularity and confluency of the osseocalcific deposits would lead one to suspect a hematoma rather than the more benign forms of meningeal osteoidomas. The history and clinical findings must always be seriously considered when attempting to make a differential diagnosis. Dyke and Davidoff pointed out that in the presence of a chronic hematoma we may find a depression of the floor of the cranial fossa in which the mass exists as compared to the opposite side. This finding is more common in the middle fossae. The osteoid changes, however, are much more commonly found in lesions over the convexities which would not be expected to influence materially the bones of the base.

Fig. 5.—Leontiasis ossea. Note the distribution of the thickened bone and its extreme density. The changes are confined chiefly to the frontal, basal, and facial bones.

Not infrequently we encounter rather widespread osteohyperplasias in the skull, and it is rather difficult to draw the line between "simple" hyperplasias and true osteomas. Certainly the condition known as general hypercraniosis which consists of a general thickening of the bones, chiefly the vault,

but without undue increase in density or porosity, is not to be considered related to a diffuse osteoma. Nor is the condition called by Moore hyperostosis frontalis interna, an osteoma, although at times the bony hypertrophy might closely simulate an osteoma. These bony overgrowths are evidently due to a basic metabolic disturbance probably endocrinopathic in origin. There is still another diffuse bony hypertrophy that is not so easily disposed of, which goes by the name of leontiasis ossea. It is a diffuse hyperostosis of dense sclerotic bone usually involving the bones of the face and often spreading to the frontal region. This strange bony overgrowth has also been known as creeping periostitis of the bones of the face and skull.

Fig. 6.—Leontiasis ossea. Same case as Fig. 5, posteroanterior view.

Leontiasis ossea is not easily placed in the catalogue of diseases. Attempts have been made to associate it with Paget's disease, but without much success. It has been thought of as a disease entity, and by some it is still so considered. Perlberg and Kruger recently reported a case which they considered a diffuse osteoma. Strangely enough this same case was studied in our clinic fifteen years ago. A comparison of the extent of the condition seen in Fig. 5, with the illustrations of the same case reported by Perlberg and Kruger, will seem to indicate that the condition progressed to a certain point and has for years remained practically unchanged. This would be compatible with the observed characteristics of a fairly diffuse osteoma of sclerotic type, but in this case the dense bony overgrowth occurred in a relatively short time which is not characteristic of the sclerotic type of osteoma.

Hamburger and Nachlas in 1926 reported finding leontiasis ossea in a case suffering with well-marked Paget's disease and concluded the two conditions were the same etiologically. But as we find these two diseases separately more often than together, it seems more likely that they are separate entities. In 1929, Ruppé reported five cases of leontiasis ossea and in one he found the condition to have involved the two upper cervical vertebrae. Such a finding is rather remarkable and would be very significant if other similar cases could be discovered, for if it could be definitely demonstrated that the condition is not localized, then we might be justified in concluding that it is not a simple diffuse osteoma.

It may be that leontiasis ossea is simply an atypical diffuse osteoma, and as we cannot very clearly define an osteoma it would be difficult for anyone to say definitely that it is not. But as the hypertrophic bone itself and its distribution, involving as it does several bones simultaneously, does not readily fit into the category of any of our better known bone diseases, it would seem better, at least for the present, to consider leontiasis ossea as a disease entity, or perhaps a form of melorheostosis.

To recognize an osteoma in the roentgenogram is usually not difficult, but one should be careful not to be too hasty in calling an area of bony overgrowth seen in the skull an osteoma until all other possibilities have been carefully considered, chiefly because the osteomas constitute only about 1 per cent of all cranial new growths. The osteomas we see in the calvarium are apt to be rather flat. They usually do not show any evidence of bone destruction, both inner and outer tables are likely to be involved, and if any vessel channels can be seen passing over the tumor they will usually appear smaller in the portion directly over the mass. This is in contradistinction to the hypervascularity one might expect to find if the hypertrophy were due to a meningioma. The spongy type of tumor may destroy the underlying or adjacent bone, so that we not infrequently see areas of decreased density about the base of the tumor.

We often find small areas of increased density in the bones of the vault. These areas are due to localized bony condensation due to anomalies of growth and development. The bone within these areas will be seen to be of normal structure but of greater density than the surrounding bone. There will be no tumefaction and no alteration in size or course of any vessel channels in the vicinity. These areas are not osteomas, but occasionally their appearance may prove sufficiently dense to be somewhat confusing.

Any bony hypertrophy seen in the nasal accessory sinuses or involving the bones of the face might well be considered an osteoma until proved otherwise. There are also small bony nodules sometimes seen in the external auditory canals. These are probably congenital and are rarely recognized in the roentgenogram. Occasionally, however, they may enlarge and take on some of the characteristics of a new growth, and might therefore be considered as at least potential osteomas.

Searching for an osteoma is somewhat like the proverbial chase of the "will-o'-the-wisp," for in either case we are not quite sure just what it is we

are after; but even so it is well worth while to carefully note the presence of these bony growths because they may and often do become a definite clinical problem.

SUMMARY

The osteomas of the head have been discussed and an attempt made to define them. Several allied conditions have also been discussed and their relationship to or independence of the osteomas considered.*

REFERENCES

1. Abraham, E.: Ueber Osteome und Exostosen am Kiefer, 1932 Berlin Dental Thesis, Jena, 1932, G. Neuenhahn.
2. Armitage, G.: Osteoma of the Frontal Sinus; With Particular Reference to Its Intracranial Complications, and With the Report of a Case, Brit. J. Surg. **18**: 565, 1931.
3. Armitage, G.: The Successful Removal of an Osteoma of the Frontal Sinus, Brit. J. Surg. **19**: 158, 1931.
4. Atkins, R. T.: Pathological Lesions of the Frontal Sinus, Laryngoscope **39**: 406, 1929.
5. Bailliart, P., and Baldenweck, L.: Ostéome de l'ethmoïde à développement orbitaire, Ann. d'oto-laryng. pp. 536-539, 1931.
6. Baldenweck, L., Mallet, et al.: Pneumatocèle frontale interne au cours de l'évolution d'un ostéome du sinus frontal, Ann. d'oto-laryng. pp. 657-668, 1934.
7. Bányai, J., and Janota, F.: Ein mandelförminges obturiendes Osteom des äusseren Gehörganges, Monatschr. f. Ohrenh. **67**: 983, 1933.
8. Bell, F. G.: Intracranial Pneumatocele (Pneumocephalus) Associated With an Orbito-Ethmoidal Osteoma, Australian & New Zealand J. Surg. **4**: 70, 1934.
9. Belot, and Kimpel, J.: Ostéome de l'occipital, Bull. et mém. Soc. de radiol. méd. de France **21**: 101, 1933.
10. Benjamins, C. E.: Les tumeurs osseuses du nez et des sinus, Monographies otorhinolaryngol. internat., 1938.
11. Benjamins, C. E., and Verbeek, F. A. L. J.: Pneumatocèle frontale interne et ostéome du sinus frontal, Ann. d'oto-laryng. pp. 881-892, 1936.
12. Bory, W.: Contribution à l'étude des ostéomes de l'ethmoïde, 1931, Paris, Thesis. Paris, 1931, M. Vigne.
13. Brütt, H.: Intracranielles Chondrom als Hirntumor, Deutsche Ztschr. f. Chir. **231**: 497, 1931.
14. Campbell, E. H., and Gottschalk, R. B.: Osteoma of Frontal Sinus and Penetration of Lateral Ventricle, With Intermittent Pneumocephalus, J. A. M. A. **111**: 239, 1938.
15. Carmody, T. E.: Osteoma of the Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **44**: 626, 1935.
16. Causse, J.: Étude anatomo-clinique des tumeurs osseuses dysgénétiques ou ostéomes du sinus frontal, Ann. d'oto-laryng. pp. 1113-1149, 1934.
17. Causse, J.: Les tumeurs osseuses dysgénétiques ou ostéomes du sinus frontal, 1934, Montpellier, Thesis. Lyons, 1934, Bosc Freres, M. & L. Riou.
18. Coates, G. M.: Osteoma Growing From the Mastoid Cortex, Arch. Otolaryng. **28**: 27, 1938.
19. Cohn, I.: Tumors of the Orbit, Tr. South S. A. (1929) **42**: 399, 1930. Disc., 419-420. Also Arch. Surg. **20**: 906, 1930.
20. Cumston: Internat. Clin. **2**: 32, 1920.
21. Cushing, H.: Experiences With Orbito-Ethmoidal Osteomata Having Intracranial Complications, With Report of Four Cases, Surg., Gynec. & Obst. **44**: 721, 1927.
22. Davidoff, L. M., and Dyke, C. G.: Relapsing Juvenile Chronic Subdural Hematoma, Bull. Neurol. Inst., New York **7**: 95, 1938.
23. De Busscher, J.: Oxycéphalie avec ostéome périorbitaire unilatéral, J. belge de neurol. et de psychiat. **35**: 614, 1935.
24. Drennan, M. R.: The Torus Mandibularis in the Bushman, J. Anat. **72**: 66, 1937.
25. Ellis, Z. H., and McKeown, H. S.: Osseous Tumors of the Orbit, Arch. Ophth. **5**: 449, 1931. Disc., 459-460. Also, Tr. Sect. Ophth., A. M. A. pp. 289-301, 1930; Disc. 301-304.

*The illustrations are from the teaching collection of the Neurological Institute of New York.

26. Ersner, M. S., and Saltzman, M.: Osteoma of the Sinuses, Laryngoscope **48**: 29, 1938.
27. Fenton, R. A.: Nasociliary Neuralgia Caused by Osteoma, Ann. Otol., Rhin. & Laryng. **42**: 911, 1933.
28. Fenyes, I.: Sur Osteohistopathologie des Tumorschädels. (Untersuchungen über die Frage der diagnostischen Verwertbarkeit röntgenographisch darstellbarer Schädelveränderungen bei gesteigertem Hirndruck.) Monatschr. f. Psychiat. u. Neurol. **78**: 61, 1931.
29. Fetissof, A. G.: The Pathogenesis of Osteomas in the Nasal Accessory Sinuses, Acta oto-laryng. **15**: 85, 1931.
30. Fetissof, A. G.: Pathogenesis of Osteomas of the Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **38**: 404, 1929.
31. Friedberg, S. A.: Osteoma of the Mastoid Process, Arch. Otolaryng. **28**: 20, 1938.
32. Gatewood, W. L., and Settel, N.: Osteoma of the Frontal Sinus; Review of the Literature and Report of a Case Presenting Extended Invasion of the Orbit, Arch. Otolaryng. **22**: 154, 1935.
33. Geschickter, C. F.: Fibrocartilaginous Tumors of Bone, Arch. Surg. **23**: 215, 1931.
34. Geschickter, C. F.: Tumors of Bone. In: A Textbook of Surgery by American Authors, Christopher, pp. 504-524 (Skull, 507), 1936.
35. Glatt, M. A.: Hyperostosis Exostosis of the External Auditory Canal, Laryngoscope **43**: 558, 1933.
36. Goodyear, H. M.: Osteoma of the Nasal Septum With a Large Epidural Abscess; Operation; Recovery, Arch. Otolaryng. **14**: 23, 1931.
37. Hamburger, L. P., and Nachlas, I. W.: Leontiasis Ossea as a Manifestation of Paget's Disease, Arch. Surg. **12**: 727, 1926.
38. Harris, R.: Osteoma of Frontal Sinus; Report of 2 Cases, Laryngoscope **38**: 331, 1928.
39. Hashimoto, M.: New Formation of Bone in Maxillary-Sinus Mucosa. Japanese text in: Otologia, Fukoka **7**: 512, 1934. German abst. in: Jap. J. M. Sc. xii. Oto-rhino-lar., Tr. & Ab. **2**: 79, 1938.
40. Hoover, W. B., and Horrax, G.: Osteomas of the Nasal Accessory Sinuses, With Report of a Case Illustrating the Transcranial Approach to Orbital Structures, Surg., Gynec. & Obst. **61**: 821, 1935.
41. Howarth, W.: Large Osteoma Causing Mucocele of the Frontal Sinus and the Maxillary Antrum, J. Laryng. & Otol. **44**: 390, 1929.
42. Krebs, A.: Diffuse Orbital Osteoma, Arch. Ophth. **21**: 195, 1939.
43. Kretschmann: Osteoma of the Skull Bones, Verbandl. d. deutsch. otol. Gesellsch. Dresden, 1910.
44. Laskiewicz, A.: Ostéome geant ethmoïdal bilatéral chez une fillette de 14 ans. (Contribution à l'étude clinique des ostéomes des fosses masles et de l'orbite.) Rev. de laryng. **57**: 175, 1936.
45. De Lehoczky, T., and Orban, A.: Hyperostosis Frontalis Interna (Stewart-Morel's syndrome), Brit. M. J. **1**: 1049, 1938.
46. Lewis, E. R.: Clinical reports showing value of systemic treatment. Two cases of rhinoscleroma. Nasopharyngeal fibroma. Osteoma of external auditory canal disappearing under systemic treatment. Recurrent nasopharyngeal fibromatous polyps, Tr. Am. Laryng., Rhin. & Otol. Soc. **38**: 459, 1932.
47. Lillie, H. I., and Williams, H. L., Jr.: Osteoma of the External Auditory Canal; Mastoiditis With Perijugular Bulb Abscess and Meningitis; Chronic Suppurative Otitis Media With Cholesteatoma and Circumscribed Labyrinthitis; Chronic Suppurative Mastoiditis With Complete Destruction of the Auricle and Atresia of the External Auditory Canal From Gunshot Wound, S. Clin. North America **2**: 801, 1931.
48. List, C. F.: Trigeminusneuralgie, verursacht durch Exostoses des Felsenbeins, Nervenarzt, **4**: 27, 1931.
49. Martin, H.: Des symptômes oculo-orbitaires dans les tumeurs des sinus de la face (frontal-ethmoïde-sphénoïde), 1929, Paris, Thesis, Paris, 1929, Jouve.
50. Masuda, S.: Osteomata of Nasal Accessory Sinuses, Japanese text in: Otologia, Fukoka **3**: 927, 1930. German abst. in: Zentralbl. f. Hals-, Nasen- u. Ohrenh. **16**: 380, 1931.
51. Moore, Sherwood: Metabolic craniopathy, Am. J. Roentgenol. & Rad. Therapy **35**: 30, 1936.
52. Nowotny, K., and Schüller, A.: Subdural Pneumokephalus bei ethmoidalem Osteom (Status epilepticus letalis nach lumbaler Luftfullung bei altem Morbus sacer), Röntgenpraxis **8**: 107, 1936.
53. Ott, W. O.: Osteoma of the Frontal Bone, Ann. Surg. **97**: 314, 1933.
54. Patterson, N., and Cairns, H.: Observations on the Treatment of Orbital Osteoma, With Report of a Case, Brit. J. Ophth. **15**: 458, 1931.

55. Payne, A. E., and Jeans, W. D.: A Case of Intracranial Pneumatocele, Brit. J. Surg. **23**: 679, 1936.
56. Perlberg, H. J., and Kruger, A. L.: Osteoma of the Skull, Am. J. Roentgenol. & Rad. Therapy **41**: 587, 1939.
57. Reich, S.: Les ostéomes du sinus frontal, 1936, Paris, Thesis, Librairie Médicale Marcel Vigné, 1936.
58. Roger, J.: Les ostéomes du sinus frontal, 1932, Paris, Thesis, Paris, 1932, A. Legrand.
59. Roy, J. N.: Volumineux ostéome de l'orbite, Ann. d'ocul. **167**: 825, 1930. Also, Union méd. du Canada **59**: 553, 1930.
60. Roy, J. N.: Volumineux ostéome orbito-cranien. Abces cerebral consecutif, d'origine nasale, Ann. d'ocul. **171**: 339, 1934. Also, Union méd. du Canada **63**: 141, 1934.
61. Ruppé, C.: The Roentgenography of Leontiasis Ossea, Presse méd. **37**: 508, 1929.
62. Scalini, F.: Voluminoso osteoma etmoidale complicato da sinusite frontale cronica riacutizzata, Boll. d. mal. d. orecchio, d. gola, d. naso **57**: 62, 1939.
63. Schneider, E.: Zur Kenntnis der Schädelosteome und der Hyperostosis frontalis, Med. Klin. **32**: 487, 1936.
64. Vincent, C., and Mahoudeau, D.: Sur un cas d'osteome ethmoido-orbitaire avec pneumatocele opere par la methode de Cushing, Rev. neurol. **63**: 993, 1935.
65. Zeliger, I.: A Case of Osteoma of the Ethmoid Sinus, Russian text in: Odesskij med. Z. **4**: 325, 1929. German abst. in: Zentralbl. f. Hals-, Nasen- u. Ohrenh. **15**: 143, 1930.
66. Zeliger, I.: A Case of Osteoma of the Frontal Sinus, Russian text in: Zhur. ush., nos. i gorl. bolez. **6**: 950, 1929. German abst. in: Zentralbl. f. Hals-, Nasen- u. Ohrenh. **15**: 95, 1930.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City.

A Contribution to the Study of Inferior Post-Normal Occlusion: By Matthew Young, N.D., and K. Corisande Smyth, L.D.S. Eng. *Dental Record* **60**: 363, September, 1940.

Many orthodontists believe that valuable information regarding the characteristic features, the nature, and possibly the origin of inferior post-normal occlusion, might be obtained by a detailed comparison of the average measurements of a comprehensive series of characters of the face and jaws in children showing this defect, with the measurements of the corresponding characters in children possessing the normal or ideal type of occlusion. Under the auspices of the Dental Disease Committee of the Medical Research Council it has been possible to carry out these measurements in relatively long series of children of both sexes with normal and post-normal occlusion respectively, ranging in age from 8 to 13 years, who were attending the elementary schools in the area controlled by the London County Council; this communication contains an account of the main differences that were found in the two groups of children and the interpretation of them.

For brevity and convenience the characters are referred to in the tables, and often in the text, by symbols, also given in the list. The characters are grouped into (1) anteroposterior (radial), (2) vertical, and (3) transverse measurements of the face, (4) measurements of the dental arches, (5) measurements of the mandible, and (6) measurements of the teeth.

Comparing the post-normal group as a whole with the normal group, the figures suggest very strongly that it is an excess of forward growth in the maxilla, rather than a retrusion or recession of the mandible, that differentiates the post-normal group as a whole from the normal in children of the age under review. This view has now received special impetus from Atkinson and his adherents.

The mean dimensions of the width of the dental arches seem to indicate quite clearly that the dental arches, and especially the upper, are at both $\underline{4|4}$ and $\underline{6|6}$ narrower in boys with post-normal than with normal occlusion, and that the divergence from the normal is greater in the upper arch. In regard to length of the dental arch, the mean value of the upper arch does not differ in the two groups, whereas the length of the lower arch in the post-normal is significantly less than in the normal. Although no emphasis can be laid on

any apparent excess in the full height of the face in the post-normal boys, it is of interest to note that there is no evidence of any reduction in comparison with the normal, at the age considered; a tendency to such a deficiency might be promoted by the prevalence of excessive close-bite in the post-normals.

The palatal height and the depth of the mandible in front do not differ in post-normal from the normal. The depth of the mandible in the molar region appears to be rather less in the post-normal. Neither in bizygomatic nor bigonial breadth of the face can the post-normal boys be said to differ from the normal.

None of the vertical measurements of the face and jaws, including the height of the palate and the depth of the mandible, can be said to differ significantly on the average in the three types of post-normal occlusion.

The length of the lower dental arch in the three types shows no difference on the average. The length of the upper arch on the other hand is, as might be expected, definitely greater on the average in type II (same as Angle's Class II division 1) than in type III (same as Angle's Class II division 2).

It was found that in all these groups the boys and girls with post-normal occlusion were definitely taller than the children at corresponding ages with normal or ideal occlusion.

With regard to the anteroposterior or radial measurements, we find that all three relating to the maxilla are at all ages significantly greater in boys with post-normal occlusion than in boys with normal occlusion.

Post-normality seems on the average to depend almost as much on a more advanced position of the maxillary jaw or upper arch as on retrusion of the mandible. A protrusion of the maxilla seems to be an important factor in relation to post-normal occlusion in girls, the proportion in which such a forward projection is found being but slightly less than that in which retrusion of the mandible occurs.

In neither the boys nor the girls is there any definite evidence that the estimates of the length of the mandible, differ in the post-normal from the normal. In neither boys nor girls with post-normal occlusion does the length of the upper arch differ from that in children with normal occlusion.

In the girls, at all the individual ages from 8 to 13 years, the external breadths of the upper dental arch at $\underline{4 \mid 4}$ and $\underline{6 \mid 6}$ and the lower dental arch at $\overline{4 \mid 4}$ as well as at $\overline{6 \mid 6}$ in the post-normal groups are significantly less than the normal. In the lower arch the deviations between post-normal and normal averages show a tendency to be less than in the upper arch. If the differences actually found in facial height may be considered to indicate any tendency, it is that there is possibly some relative shortening of the face in the post-normals.

The main result of the investigation is to provide very suggestive, if not conclusive, evidence that the origin of inferior post-normal occlusion in the great majority of the boys, but in a smaller proportion of the girls examined, is essentially dependent on the degree of forward growth or the position of

the maxilla, and not on retrusion of the mandible. When protrusion of the maxilla and retrusion of the mandible co-exist, the proportion in which protrusion is the most prominent feature is, in both sexes, equal to that in which retrusion predominates. Children with the two principal types of post-normal occlusion do not appear to show significant differences in any of the characters brought under review unless it is in the two, transmeatal axis to maxillary incisor incisal margin and the length of the upper dental arch, in which the divergence largely depends on the mode of differentiation of the two types.

Appearance of Skeletal Abnormalities in the Offspring of Rats Reared on a Deficient Diet: By J. Warkany and R. C. Nelson. *Science* **92**: 383, Oct. 25, 1940.

The following observations were made by the authors at the Children's Hospital Research Foundation and Department of Pediatrics, University of Cincinnati College of Medicine. Rats which were reared on deficient diets were bred. One group of females was reared on a diet consisting of yellow cornmeal 76 per cent, wheat gluten 20 per cent, calcium carbonate 3 per cent, sodium chloride C.P. 1 per cent (Steenbock and Black rachitogenic diet No. 2965), which was supplemented with viosterol (each rat received 60 I.U. every tenth day). On this diet the animals were retarded in growth and development. A total of 164 young was born either spontaneously or by cesarean section; of these, 107 were apparently normal, while fifty-seven presented multiple congenital abnormalities. An abnormally short mandible was found in thirty-nine animals. This defect was so marked that the tongue was exposed to a large extent.

Many animals also had deformed extremities. Syndactylism of different grades was observed in thirty-two young. A short tail was seen in twelve animals. One hundred and four of the young were cleared by the Spalteholz method to facilitate the study of the skeleton. In forty-two of these specimens the lower legs showed reduction in size or absence of the tibia; in twenty the fibula was shortened or absent; in twenty-two there was fusion of the ribs; and in fourteen there was fusion of the centers of ossification of the sternum.

Another group of females of the same strain was reared on a more adequate diet consisting of yellow cornmeal 78 per cent, wheat gluten 18 per cent, calcium carbonate 1 per cent, sodium chloride C.P. 1 per cent, and dried pig liver 2 per cent. This diet resulted in much better growth and development of the animals. This group consisted of twenty-four females which had thirty-nine pregnancies resulting in 294 young. None of the latter showed deformities of the mandible or extremities like those described in the previous group.

A third group of twelve female rats of the Sprague-Dawley strain was raised on an adequate diet (Bill's modification of Steenbock's stock diet). Thirty litters born to these animals consisted of 216 young. One abnormal animal was noted in this group. It weighed only 2½ grams and when cleared showed short femurs and an abnormal sternum. They are extending these experiments along both genetic and nutritional lines.

Stainless Steel Alloys: *Science* **92**: 10, Nov. 1, 1940.

That proper balance of the amounts of the metals alloyed with iron in making stainless steel was found necessary to give the best corrosion resistance combined with good workability, was reported at the Cleveland meeting of the American Society for Metals. The research was carried out by Russell Franks, W. O. Binder, and C. R. Bishop, of the Union Carbide and Carbon Research Laboratories. These types of stainless steel consist of iron with the addition of chromium, nickel, and molybdenum. The best properties were found with the following percentages of these elements: 18 to 19 per cent chromium; 12 to 14 per cent nickel; 1.5 to 2.25 per cent molybdenum, and not more than 1/10 per cent of carbon. By adding columbium, a somewhat rarer metal, still further improvement was obtained.

Mammalian Genetics: By William E. Castle, Professor Emeritus of Genetics, Harvard University Research Associate in Genetics, University of California. Illustrated. Pp. 164, cloth, price $2.00, Cambridge, Harvard University Press, 1940.

This volume provides an introduction to the study of heredity in mammals. While human heredity is not included in this volume, the book will nevertheless be found interesting by workers in the afore-mentioned field since it provides a sound basis for generalization and because experimental investigation in human heredity is impossible. The chapters on heredity in general and on Mendelian inheritance are concise and lucid. They may be easily comprehended by those who have often floundered through a sea of jargon in the pursuit of information on the subject.

Castle describes *lethal genes*, those which cause the death of an individual at birth. He then goes on to explain "sub-lethal" genes, those which produce harmful, but not necessarily fatal effects. These harmful defects take the form of hereditary diseases and may show themselves in the muscles, sense organs, the blood, and other systems. This should make it easier for orthodontists to accept the fact that certain dentofacial abnormalities may be of direct genetic etiology.

Body size in mammals is accepted as being of genetic influence. However, in domestic animals, in the absence of natural selection, differences in body size are greater than in the state of nature. These and other related topics are discussed. An important bibliography is appended. The book has a good index.

Outline of Physiology: By William R. Amberson, Ph.D., Professor of Physiology, University of Maryland, and Dietrich C. Smith, Ph.D., Associate Professor of Physiology, University of Maryland. Illustrations by Norris Jones, Instructor in Scientific Illustrating, Swarthmore College, Pp. 412, price $4.00, Baltimore, The Williams and Wilkins Co., 1939.

This is a mammalian—and mainly human—physiology with some general material as a necessary foundation. The historical approach is frequently

used, with extensive quotations from classical papers. Each chapter is headed by appropriate quotations mostly from the early investigators in physiology.

The book lays a groundwork of basic biochemical and biophysical conceptions as preparation for the later more strictly physiologic discussions. It includes simple descriptions of the recent advances in physiology such as x-ray analysis of muscle structure, electrical discharges in nerves and brain, the vitamins, and the endocrine glands. It presents simplified diagrams in color to illustrate the structure and function of the central nervous system.

Orthodontists will find of especial interest the chapters on the endocrines and on the reflex control of posture and movement. An excellent index is provided.

Editorials

The Wuerpel Influence in Orthodontics

No doubt, the most important contribution to orthodontic progress in the past by any lay influence was that of the well-known artist, Dr. Edmund H. Wuerpel. Starting back about the turn of the century, he was a powerful inspiration to the late Dr. Edward H. Angle, as well as to many of Dr. Angle's students. In addition to that, he appeared many times on the official programs of various orthodontic societies throughout the land. Practically all textbooks pertaining to orthodontics reflect the Wuerpel influence in their treatment of harmony of the face and features as related to the teeth and dental arches.

Inasmuch as the Wuerpel influence is a well-known factor in orthodontic progress, and has been the balance wheel in maintaining a sense of proportion in treating living things, and an appreciation of natural forms, readers will be interested in excerpts from the editorial comment recently of the *St. Louis Globe-Democrat*, pertaining to the wide influence of artistic values which have emanated everywhere from this great artist. Orthodontics is proud of the Wuerpel influence on its evolution.

> "To one who has labored so long and loyally in the cause of art as Dr. Edmund H. Wuerpel, manifestation of National Art Week as it is being expressed . . . this week must be reassuring as well as gratifying. For standing out dominantly among the 1,000 or so exhibitors in the special display marking the local participation in the national observance is the work of artists who have been his pupils or his pupils' pupils or the work of his associates in Washington University's St. Louis School of Fine Arts and their pupils, ranging the 30 years Dr. Wuerpel headed the school and of which he is now director emeritus.
>
> "This reflection of principles of color and form firmly implanted and lessons well learned serves as reassurance that Dr. Wuerpel and such other pioneers . . . as his predecessors, Prof. Halsey Ives, by precept and example broadcast their seed widely and in fertile fields. . . .
>
> "Dr. Wuerpel, St. Louis is proud to know, is a native of this town and has lived here most of his 75 years. He was connected with the St. Louis School of Fine Arts for 44 years up to the time of his retirement two years ago and for the last 30 years of his service was director. So his influence runs back through some 10,000 student potentialities and may be noted now in artists well on toward the evening of life.
>
> "His own work, which continues with enthusiasm and is encouraged by freedom from teaching duties—that is classroom duties—has been permeated with a quiet contemplation of the mystery of forms, the gentle undulations of this fruitful earth, the curving of life-giving streams, the fecund shapes of trees, billowing clouds, and always by

lyric serenity, a satisfaction, though never a self-satisfaction in the presence of the mystery of beauty. These things for his own brushes and these things for the brushes of his pupils through nigh on to a half century. His subtlety of expression has influenced the art of painting in St. Louis and will live far beyond his years.''

Dr. Wuerpel inspired orthodontists in the pioneering days of the specialty, and many readers of this JOURNAL will recall the appearance of Dr. Wuerpel on programs from the Atlantic to the Pacific coast, and his pleadings that orthodontists not lose sight of the artistic values surrounding their vocation.

H. C. P.

An Orthodontic Institution Devoted to Advance and Service

There is an ever-increasing interest in the care of the crippled child, not only in the prevention and correction of his deformities, but also in his economic and social rehabilitation. Service clubs which make their principal theme the benefit and health of the underprivileged child are numerous. Probably no service for crippled children is better known than that given by the Shriners' Hospitals for Crippled Children throughout America, and in these instances, in most communities the institution is headed by an orthopedic surgeon, ably assisted by physical therapeutists.

There is a great gap between the immediate surgery and the final functional end result in orthopedic surgery. This is not usually true in many other branches of health service. However, a similar condition does exist in orthodontic service, in that the element of time in treatment is an important factor and, in addition, the end result is not attained until some time after all appliances have been removed.

In the treatment of orthopedic conditions one is confronted not only with surgical management, but also with the economic factor, which includes the length of time required for recovery, the restriction of activity during this period, and, finally, the residual permanent disability after dismissal.

On account of the tedious painstaking personal and highly specialized skill that is required of modern orthopedic surgeons, it was thought for years that this service could not be extended to the wider brackets of society other than by the extension of private practice and the training of more and more skilled men. Then someone conceived the idea that with sufficient endowments and amply trained assistants and nurses in a well-organized institution, many, many cases of indigent children could be cared for under the direction and supervision of one or two highly skilled orthopedic surgeons.

This plan was put into effect, and now any deserving child in need of the expert services of an orthopedic surgeon is provided such service through philanthropic and endowed agencies. What service is more highly regarded than that of orthopedic surgery? The world now has reverence and respect for the humanitarian and skilled work of those who have made all this possible.

What significance may this have to the orthodontic problem? Is not the history of orthopedics being again repeated in the field of orthodontics?

It has been thought by many for years that because of the high degree of personal skill required to correct malocclusions with dispatch and precision, as is done by our leading operators, and the limitations imposed on orthodontists' time on account of direct conflict with school hours, the specialty does not lend itself, from a practical standpoint, to a wide extensive service, at least under the present setup of practice. After spending two or three days in the office of a skillful orthodontist handling a large volume of cases by himself, other than with the assistance of ample and well-trained office assistants, it will be admitted by most men that it can be done by those who have both sufficient energy, skill, and organization ability.

The time has arrived in orthodontic progress when it is both practical and feasible to establish an endowed institution with ample resources under skillful guidance not only to give modern orthodontic service to indigent children, but also to provide at the same time ample opportunity for modern orthodontic training for those who believe that orthodontic skill is best obtained by "doing" under the trained eye and guidance of masters who have a record behind them of hundreds and hundreds of successfully treated cases. Not unlike the method of rating in big league ball clubs, the batting average is the answer to the amount of skill and ability. So it is with the skill of an orthodontist. One with a high average of successfully treated cases and the unquestioned respect and confidence of his confreres should head such an institution. Let it be hoped an altruistic individual or institution will make it possible for such a thing to happen for the benefit of childhood and for the benefit of the advancement of orthodontics to a further degree of intrinsic merit as a health service. Orthodontics can do as much for childhood as orthopedic surgery has accomplished if it be provided a similar vehicle.

H. C. P.

News and Notes

American Association of Orthodontists

The Thirty-Ninth Meeting of the American Association of Orthodontists will be held at the Waldorf Astoria Hotel in New York City, May 5 to 8, 1941.

Central Association of Orthodontists

The Central Association of Orthodontists will have a luncheon meeting during the mid-winter meeting of the Chicago Dental Society. The time of the meeting will be announced later.

Chicago Dental Society

The Seventy-Seventh Annual Midwinter Meeting of the Chicago Dental Society will be held at the Stevens Hotel, Feb. 17 to 20, 1941. All members of the Society and the A. D. A. are invited.

Argentine Orthodontic Society

The officers recently elected for the Argentine Orthodontic Society, with headquarters in Buenos Aires, are as follows:

President.....Prof. Dr. A. Monti
Vice-president...Dr. M. A. Finocchietti
Secretary.....Dr. R. O. Antier
Treasurer.....Dr. E. G. Locci

Members of the governing body:

Dr. V. A. Bertini
Dr. R. Torres
Dr. D. Bianco
Dr. G. A. Sammartine

Five State Postgraduate Clinic

The Tenth Annual Five State Postgraduate Clinic of the District of Columbia Dental Society will convene at the Mayflower Hotel, Washington, D. C., March 9 to 13, 1941.

Southwestern Society of Orthodontists

The Twentieth Annual Meeting of the Southwestern Society of Orthodontists will be held at the Hilton Hotel, Lubbock, Texas, Feb. 2 to 5, 1941. The tentative program is as follows:

Monday:

Invocation, address of welcome and response, introduction of guests, president's address, and report of committees.

James D. McCoy, D.D.S., Los Angeles, Calif.:

A, Naming Dental Anomalies—A Study in Orthodontic Nomenclature.

B, Recording Dental Anomalies for Clinical Appraisal. Discussion to be led by W. E. Flesher, Oklahoma City, Okla.

F. B. Malone, M.D., Lubbock: Coordination Between the Otolaryngologist and the Orthodontist. Discussion to be led by Homer B. Robinson, Hutchinson, Kan.

Curtis Williams: Case Report—Anterior Occlusion. Discussion to be led by T. O. Gorman, San Antonio, Texas.

James D. McCoy: A Technique for Making Denture Reproductions and Facial Records. Discussion to be led by O. H. McCarty, Tulsa, Okla.

Arnold-Cunningham-Gillian, Houston, Texas, exhibit and teaching group.

Tuesday:

James D. McCoy: Examples From Practice Showing the Necessity for Differential Diagnosis and the Application of Rational Treatment Principles. Discussion to be led by Clarence Koch, Little Rock, Ark.

The Army and the Orthodontist. Discussion to be led by T. G. Duckworth.

Lonnie Langston, Lubbock: Conserving the Estate. Discussion to be led by W. T. Chapman, El Paso, Texas.

Clinics.

Combined meeting of the Lubbock Dental Society and the Southwestern Society.—James D. McCoy: The General Health Benefits of Orthodontic Treatment, Discussion to be led by P. G. Spencer (30 minutes) and Military Dentistry, to be led by Curtis Williams (15 minutes).

Wednesday:

James D. McCoy: A clinic demonstrating the simple but effective mechanisms used in the many cases shown. Dr. McCoy will be assisted by E. B. Arnold, W. B. Stevenson, Louis S. Winston, A. B. Conly, and J. H. Weaver.

Mexican Association of Orthodontists

The newly elected officers of the Asociacion Mexicana de Ortodoncia are the following:

President_____Dr. Carlos M. Paz

Secretary_____Dr. Samuel Fastlicht (Madero 40, Mexico City)

Treasurer_____Dr. Guillerma S. Gamboa

Notes of Interest

Dr. William E. Flesher takes pleasure in announcing that his son, Dr. Marion A. Flesher, has become associated with him in the practice of orthodontics, Medical Arts Building, Oklahoma City, Okla.

Dr. Harry E. Kelsey of Baltimore, Md., has announced his retirement from practice and that he will be succeeded in practice by Dr. Hammond L. Johnston. Dr. Johnston was formerly associated with both Dr. Kelsey and Dr. George M. Anderson. The practice will be continued at the same location, 833 Park Avenue, Baltimore.

Dr. Walter H. Ellis announces the removal of his office to The Linwood Medical Centre, 333 Linwood Avenue, Buffalo, N. Y. Practice limited to orthodontics.

The Committee on Dental Preparedness

The Committee on Dental Preparedness, in a meeting held in Washington, D. C., in October, took several steps in continuing the preparedness program which was outlined at the annual meeting of the A. D. A. in Cleveland.

One matter of interest to all practitioners is the beginning of a study to perfect ways and means of protecting the practice of those men who might be called into the Service. A few local societies have already taken action on this matter, and it was decided to form a sub-committee of the Preparedness Committee to study the problems and report back to the

Committee as a whole. This subcommittee is composed of Drs. Waugh, Robinson, and Bruening, and the result of their deliberations will be made known at the earliest possible moment.

It was announced to the Committee by Brigadier General Leigh C. Fairbank that an order had been passed suspending the issuance of commissions in the Dental Reserve Corps. This was done in order to protect those men who might be drawn into the service under the present Conscription Law.

General Fairbank stated that in the event a dentist had a low-call number or if he is drafted, he should immediately make application for a commission, accompanying the application with a statement from his local draft board in support of his position in the draft call. It was stated that these applications could be speedily acted upon and that provided the application could be granted favorable action, the commission would be authorized.

The questionnaires continue to be returned but at a greatly diminished rate. To date, approximately 56 per cent of those questionnaires which have been mailed, have been returned. Obviously, no conclusive results can be forthcoming from such a return, and an appeal is made to those men who have not returned their questionnaire to do so at once.

If a dentist has not received a questionnaire, all he need do is to send a postal card to the AMERICAN DENTAL ASSOCIATION, 212 East Superior St., Chicago, Ill., and a copy will be mailed immediately.

To satisfy the hopes of using the returned questionnaires as a basis for a complete dental directory, no person, regardless of age or position, should fail to respond.

Michigan Dental Ad Law Is Upheld

Michigan voters, in a state referendum in November, upheld an act of the 1939 legislature abolishing advertising by dentists. The act, which becomes effective immediately, provides, in addition to higher standards for dentists, that no dentist advertise prices. The Michigan Press Association unsuccessfully combated the measure, supporting a group of advertising dentists who forced a statewide referendum. The association had contended restriction of advertising would threaten free competition and even freedom of the press. Under the new act, no dentist may own or manage more than one office and operate them under his own name with employed operators. The final vote was three to two in favor of the act as passed by the legislature.

National Bureau of Standards Tests on Dental Materials

The investigations and tests of dental materials made in the laboratories of the National Bureau of Standards, Department of Commerce, are a service conducted on a research associate basis for the American Dental Association and reach more than 50,000 American dentists in the form of reports on new materials and new techniques. An annual list of restorative materials which is made available by the Association to all practicing members includes over 200 trade brands, all of which have been tested at the Bureau and are guaranteed by their manufacturers to comply with the standards of the Association. This list of tested products is constantly under scrutiny and is revised each month by the addition of newly perfected brands and the elimination of those found defective.

In view of the recognized importance of dentistry in relation to general health, it is obvious that the quality of dental materials is a matter of considerable public significance. The use of faulty products almost invariably results in unsatisfactory dental work and loss of confidence on the part of the public. With the reports of the Bureau of Standards available, it is pointed out, dentists are protected against exploitation by manufacturers and salesmen who may try to sell new and unproved, and in some cases, defective products. This direct advisory service has proved its worth and today is recognized in many foreign countries as an important factor in placing American dental work so far in advance of the rest of the world.

OFFICERS OF ORTHODONTIC SOCIETIES*

American Association of Orthodontists

President, Henry U. Barber, Jr. - - - - - 5 East Fifty-Seventh St., New York, N. Y.
Secretary-Treasurer, Max E. Ernst - - - 1250 Lowry Medical Arts Bldg., St. Paul, Minn.
Public Relations Bureau Director, Dwight Anderson
- - - - - - - - - - - - - - - - - - 292 Madison Ave., New York, N. Y.

Central Association of Orthodontists

President, Harold J. Noyes - - - - - - - - - 55 E. Washington St., Chicago, Ill.
Secretary-Treasurer, L. B. Higley - - - - - - - - 705 Summit Ave., Iowa City, Iowa

Great Lakes Society of Orthodontists

President, Frank S. Cartwright - - - - - - - - Henry Ford Hospital, Detroit, Mich.
Secretary-Treasurer, Richard E. Barnes - - - - - - Republic Bldg., Cleveland, Ohio

Harvard Society of Orthodontists

President, I. D. Davis - - - - - - - - - - - - - 419 Boylston St., Boston, Mass.
Secretary-Treasurer, Edward I. Silver - - - - - - - 80 Boylston St., Boston, Mass.

New York Society of Orthodontists

President, Glenn F. Young - - - - - - - - - - 745 Fifth Ave., New York, N. Y.
Secretary-Treasurer, William C. Keller - - - - 40 E. Forty-Ninth St., New York, N. Y.

Pacific Coast Society of Orthodontists

President, Will G. Sheffer - - - - - - - - - - Medico Dental Bldg., San Jose, Calif.
Secretary-Treasurer, Earl F. Lussier - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, A. B. Brusse - - - - - - - - - - - - 1558 Humboldt St., Denver, Colo.
Secretary-Treasurer, Robert L. Gray - - - - - - - - Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Fred G. Hale - - - - - - - - - - - Professional Bldg., Raleigh, N. C.
Secretary-Treasurer, T. C. Sparks - - - - - - 1508 Washington St., Columbia, S. C.

Southwestern Society of Orthodontists

President, G. C. Turner - - - - - - - - - - - 406 Myrick Bldg., Lubbock, Texas
Secretary-Treasurer, R. E. Olson - - - - - - Union Nat'l Bank Bldg., Wichita, Kan.

Washington-Baltimore Society of Orthodontists

President, George M. Anderson - - - - - - - - - 831 Park Ave., Baltimore, Md.
Secretary-Treasurer, Stephen C. Hopkins - - - - - 1726 Eye St., Washington, D. C.

American Board of Orthodontics

President, Harry E. Kelsey - - - - - - - - - - 833 Park Ave., Baltimore, Md.
Vice-President, Frederic T. Murlless, Jr. - - - - 43 Farmington Ave., Hartford, Conn.
Secretary, Charles R. Baker - - - - - - - - - 636 Church St., Evanston, Ill.
Treasurer, Bernard G. DeVries - - - - - - Medical Arts Bldg., Minneapolis, Minn.
William E. Flesher - - - - 806 Medical Arts Bldg., Oklahoma City, Okla.
Frederic T. Murlless, Jr. - - - - - - 43 Farmington Ave., Hartford, Conn.
Oliver W. White - - - - - - - - 213 David Whitney Bldg., Detroit, Mich.
James D. McCoy - - - - - - - - 3839 Wilshire Blvd., Los Angeles, Calif.

Foreign Societies†

British Society for the Study of Orthodontics

President, S. A. Riddett
Secretary, R. Cutler
Treasurer, Harold Chapman

---

*The Journal will make changes or additions to the above list when notified by the secretary-treasurer of the various societies. In the event societies desire more complete publication of the names of officers, this will be done upon receipt of the names from the secretary-treasurer.

†The Journal will publish the names of the president and secretary-treasurer of foreign orthodontic societies if the information is sent direct to the editor, 8022 Forsythe, St. Louis, Mo., U. S. A.

INDEX TO VOLUME 26

AUTHORS INDEX

A

ANDERSON, BERT G., AND HURME, VEIKKO O., Malocclusion in a group of postrachitic and nonrachitic adolescent children, 1119

ATKINSON, SPENCER R., Growth and development of teeth and jaws (a) mandible (b) maxilla, 829

B

BARTELS, HENRY A., Review of recent literature dealing with transient bacteriemias, 366

BAUER, WILLIAM H., Importance of histologic picture of osteomyelitis of jaws following extraction of teeth for treatment, 150

BEAN, HARVEY G., President's address, Great Lakes society of orthodontists, 1117

BECKWITH, J. HOLDEN, Positioning for correct anglization in radiograms, 600

BELL, BROOKS (*See* Siersma, Shanley, Perrin, Herbert, and Bell), 875

BERGER, HEINRICH, Constitutional aspects of orthodontic problems, 566

BLUMENTHAL, FRED RALPH, Bite planes, 125

BOX, HAROLD K., The maintenance of enamel integrity during orthodontic treatment, 1138

BOYLE, PAUL E. (*See* Weisberger, Nelson, and Boyle), 88

BRAWLEY, ROBERT E., AND SEDWICK, H. JOBE, Studies concerning oral cavity and saliva, 41

BREITNER, CARL, Bone changes resulting from experimental orthodontic treatment, 521

—, Influence of moving deciduous teeth on the permanent successors, 1152

BROCK, H. M., Case report No. 40, effect of maxillary impacted third and fourth molars on ciliary nerves of eye, 712

BRODIE, ALLAN G., Some recent observations on growth of face and their implications to orthodontists, 741

BROWN, JAMES BARRETT, Double elongations of partially cleft palates and elongations of palates with complete clefts, 910

—, Utilization of temporal muscle and fascia in facial paralysis, 80

C

CAHN, LESTER R., Studies in leucoplakia, 492

CALLAWAY, GEORGE S., Use of bite planes, 120

—, Latex rubber as orthodontic aid, 353

D

D'ALISE, C.: Constitutional diseases in prognosis of orthodontic treatment, 955

DE APARICIO, FERNANDO MARTINEZ, Distoclusion with protraction of maxillary incisors, 597

DINGMAN, REED O., Diagnosis and treatment of lesions of temporomandibular joint, 374

DOHERTY, JOSEPH A., Oral surgical conditions and their treatment, 1195

E

ELLIOTT, FREDERICK C., Relation of orthodontics to present social trend, 338

F

FAIRBANK, BRIG. GEN. LEIGH C., Dentistry and national defense, 1074

—, Orthodontics—its place in military dentistry, 313

FASTLICHT, SAMUEL, Status of orthodontics in Latin America, 1067

FISCHER, BERCU, Orthodontic photographic recorder, 139

—, The Denti-Phore, a method for making oriented casts and recording dentofacial changes, 941

FISHER, ARTHUR F., AND WALLACE, W. R. J., Pathologic fractures of the mandible predisposed by osteomyelitis, 896

FRANCIS, CARL C., Record of health, 758

FRANK, VICTOR H., AND FRASHER, CHARLES B., Evaluation of preoperative tests for anesthetics, 473

FRASHER, CHARLES B. (*See* Frank and Frasher), 473

G

GIBLIN, WILLIAM A., Practical thoughts on orthodontics, 881

GINGRASS, R. P., Plastic surgery of face, 961

GOLDMAN, HENRY M., Case report No. 34, acute aleucemic leucemia, 89

GRIFFIN, EDWARD M., Response to paper by Dr. Moskowitz, "Time to begin orthodontic treatment," 556

GRINNELL, WILLIS H., Philosophy of treatment with lingual arch, 330

GROSBY, JEROME S., Logical approach to therapeutics, 360

GROSS, P. PHILIP, Case report No. 42, thirteen impacted and unerupted teeth in one mouth, 916

H

HARRIS, ROBERT S., Promise of nutrition: nourish and flourish, 448

HAYNEN, ARTHUR S., Mandibular resection, 793
HELLMAN, MILO, Development of face and dentition in its application to orthodontic treatment, 424
—, Orthodontic results many years after treatment, 843
HERBERT, GEORGE H. (*See* Siersma, Shanley, Perrin, Herbert, and Bell), 875
HIGLEY, L. B., Lateral head roentgenograms and their relation to orthodontic problem, 768
HITZELBERGER, A. C., Case report No. 36, noma of cheek, 290
HOFFMAN, M. M., AND SCHOUR, I., Quantitative studies in development of rat molar, 854
HOPKINS, CHARLES B., Apical infection vs. cyst, 684
HOPKINS, STEPHEN C., Bite planes, 107
HOWARD, CLINTON C., Comments on "Limitations of Treatment," 613
HUNT, HOWARD B., Cancer of lip, 1181
HURME, VEIKKO O. (*See* Anderson and Hurme), 1119

J

JACKSON, ANDREW F., Snap-channel, tie-lock attachment, 1046
JACOBS, MAX H., Case report No. 43, fibro-osteoma (osteitis fibrosa localizata) clinically and radiographically resembling Ewing's tumor, 1002
—, AND STONE, HARRY, Cysts of jaws, 690
JOHNSON, A. LEROY, Constitutional factor in skull form and dental occlusion, 627
JOULE, WILLIAM R., Results of use of sliding yoke, 24

K

KAZANJIAN, V. H., Congenital absence of ramus of mandible, 175
—, Surgical treatment of abnormalities of edentulous alveolar processes and palate, 263
KELSEY, HARRY E., American board of orthodontics, 57
KLATSKY, MEYER, Cinefluorographic study of human masticatory apparatus in function, 664
KOHN, LEONARD, Children's bridgework prevents crooked teeth, 259
KOHN, SIDNEY IRVING, Facial fistulas of dental origin, 797
KRESHOVER, SEYMOUR J., Histopathologic studies of abnormal enamel formation in human teeth, 1083

L

LEVY, M. D., Influence of endocrines on teeth and jaws, 671
LOSCH, P. K., AND WEISBERGER, D., Case report No. 44, high caries susceptibility in diminished salivation, 1102
LYNCH, DANIEL F., Adamantinoma, 487
—, Osteomyelitis of jaws, 584

M

MARGOLIS, HERBERT I., Standardized x-ray cephalographics, 725
MCDONOUGH, F. J., Treatment and complications in fractures of maxillary bones, 162
MCINTOSH, FRED E., Hypertrophy of the gums due to administration of dilantin sodium, 908
—, Retention procedures, 37
MEAD, STERLING V., Control of hemorrhage, 982
—, Study of comparative efficiency of bactericidal and bacteriostatic agents in mouth, 968
MILLIETTE, G. T., Factors contributing to facial growth and development, 1036
MORGAN, JAMES G., AND THOMA, KURT H., Case report No. 39, mandibular mixed tumor of salivary type, 602
MOSKOWITZ, MAURICE, Time to begin orthodontic treatment, 548
MURLLESS, FREDERIC T., JR., Study in tempering precious metal alloys, 29
MURRAY, WILLIAM A., President's address, American association of orthodontists, 623

N

NELSON, C. TRUMAN (*See* Weisberger, Nelson, and Boyle), 88

O

OLIVER, OREN A., Orthodontics as supplement to all restorative dentistry, 320
OPPENHEIM, ALBIN, Artificial elongation of teeth, 931
ORSECH, GEORGE E., Use of hydro-colloidal impression material in orthodontics, 228

P

PERRIN, MARK. (*See* Siersma, Shanley, Perrin, Herbert, and Bell), 875

R

REHÁK, RUDOLF, Biometric norm values as basis for choice of our appliances or methods of treatment, 1052
RESCH, C. A., Oral manifestations of leucemia, 901
ROBINSON, THOMAS O., Paresthesia: postoperative complication following removal of mandibular third molar, 278
ROGERS, ALFRED P., Myofunctional treatment from a practical standpoint, 1131
ROHDE, A. C., Factors contributing to facial growth and development, 1027
ROTH, GEORGE J., Analysis of articulate sounds and its use and application in art and science of dentistry, 1
ROUNDS, FRANK W., Influence of George B. Winter on development of exodontia, 285
RUSSELL, L. T., Extraoral removal of root displaced by gunshot wound, 391

S

SALMAN, IRVING, Local anesthesia, 803

SCHOUR, I. (*See* Hoffman and Schour), 854

SCHWARTZ, CHARLES WADSWORTH, Cranial osteomas, 1199

SEDWICK, H. JOBE (*See* Brawley and Sedwick), 41

SHANLEY, LEO (*See* Siersma, Shanley, Perrin, Herbert, and Bell), 875

SIERSMA, GEORGE H., SHANLEY, LEO, PERRIN, MARK, HERBERT, GEORGE H., AND BELL, BROOKS, The use of chrome alloy, 875

SILLMAN, J. H., Serial study on occlusion from birth to three years, 207

SMITH, RICHARD A., Treatment requiring tipping and bodily movement of teeth, 779

SQUIRES, FRANKLIN A., President's address, New York society of orthodontists, 419

STAFFORD, HENRY E., Relationship of orthodontics to pediatrics, 325

STERRETT, D. S., Report of case of submerging first molar, 681

STEUER, IRWIN F., Report of two cases of malocclusion accompanied by distortion of fingers as result of finger-sucking, 242

STONE, HARRY (*See* Jacobs and Stone), 690

STRANGE, HOWARD ELLIOT, Three-dimensional consideration of occlusion, 787

SZENTHE, I., Critical review of some orthodontic theories, 47

T

THOMA, KURT H., Calcification of stylo-mandibular ligament, 812

—, Case report No. 37, dilantin hyperplasia of gingivae, 394

THOMA, KURT H., Case report No. 38, anodontia in ectodermal dysplasia, 503

— (*See* Morgan and Thoma), 602

THOMPSON, EDWARD C., Management of various types of dental surgical cases, 64

TISDALL, FREDERICK F., Present status of vitamin therapy, 1178

W

WAHL, LEONARD P., Developmental growth of face in relation to denture, 234

WALLACE, W. R. J. (*See* Fisher and Wallace), 896

WATSON, WILLIAM V., Medico-dental problems, 1146

WAUGH, LEUMAN M., Growing perfect teeth, 356

WEAVER, J. H., President's address, Southwestern society of orthodontists, 309

WEINBERGER, BERNHARD WOLF, John Hunter and his natural history of human teeth, 246

WEISBERGER, DAVID, NELSON, C. TRUMAN, AND BOYLE, PAUL E., Development of caries in teeth of albino rats following extirpation of salivary glands, 88

— (*See* Losch and Weisberger), 1102

WILKINSON, L., Factors contributing to facial growth and development, 1019

WINSTON, LOUIS S., Neutroclusion, with one peg lateral incisor and one lateral incisor missing, 465

WINTER, FRED, Report on treatment of Class III, 346

WINTER, LEO, Blood dyscrasias, 67

WOODBURY, WILLIAM W., Trend of orthodontic teaching and investigation as primary dental concern, 130

Y

YATES, MORTON F., Case report No. 35, mandibular cyst with infections, 188

SUBJECT INDEX

A

Abnormalities of edentulous alveolar processes and palate, surgical treatment of, 263
skeletal, appearance of, in offspring of rats reared on deficient diet, 1213 (Abst.)
Absence, congenital, of ramus of mandible, 175
Acta odontologica Scandinavica, dental journal, 193 (Abst.)
Adamantinoma, 487
operative treatment of, 490
Aderer, Julius, note on death of, 929
Agents, bactericidal and bacteriostatic, in mouth, study of comparative efficiency of, 968
used in treating gingival disease, 362
Agranulocytosis, 78
Aid, orthodontic, in periodontia and prosthesis, 93 (Abst.)
Alloy, chrome, use of, 875
used in retentive measures, 37
Alloys, precious metal, study in tempering, 29
stainless steel, 1214 (Abst.)
Alveolar processes, edentulous, and palate, abnormalities of, treated by surgery, 263
ridges, deformed, prevention of, 267
America, Latin, status of orthodontics in, 1067
American association of orthodontists, 103, 200, 305, 411, 516, 1219
president's address, 623
board of orthodontics, 306, 412
report of, 889
work of, 57
dental association, 519, 621, 723, 825, 1016
Anatomy, developmental, 512 (B. rev.)
human, principles of, 521 (B. rev.)
of maxillary and mandibular gum pads, 208
Anemia, aplastic, 72
molasses as part of diet in treating, 192 (Abst.)
primary, 67
pernicious (Addisonian anemia), 67
secondary, 70
Anesthesia, local, 803
Anesthetics, evaluation of preoperative tests for, 473
Ankylosis of temporomandibular joint, 385
Anodontia in ectodermal dysplasia, 503
Anomalies of shapes and number of teeth and question of their hereditary significance, 190 (Abst.)
Appliances or methods of treatment, biometric norm values as basis for choice of, 1052
Applications of phonetic groups of oral phonetic curve in speech, 8
Arch, lingual, philosophy of treatment with, 330
twin, technique, in chrome alloy, 879
Arches, dental, in children, growth and development of, 1105 (Abst.)
maxillary and mandibular, interrelationship of, from birth to 3 years, 214
Argentine orthodontic society, 1219
Arthritis of temporomandibular joint, 377
Ashplant, Percy Roy, in memoriam, 407
Aspects, constitutional, of orthodontic problems, 566
Attachment, snap-channel, tie-lock, 1046

B

Babies are human beings, 817 (B. rev.)
Bacterial endocarditis, 370
subacute, 371
Bacteriemias, following tooth extraction, 367
transient, review of literature dealing with, 366
Bands, intermaxillary rubber, 522
Bite, jumping of, 526
planes, 107, 120, 125
made of silver-tin, 816 (Abst.)
pressure in studies of oral cavity, 42
raising of, by plates or similar devices, 532
Biting urge, 223
Bizygomatic breadth as constitutional factor, 567
Blood dyscrasias, oral manifestations of, 67
elements, study of, in prevention of hemorrhage, 986
pressure, importance of, in capillary system of pericementum, 47
Bone, alveolar, cementum, and eruption, studies of development of, of rat molar, 854
changes resulting from experimental orthodontic treatment, 521
Bones, maxillary, treatment and complications in fractures of, 162
Breadth, bizygomatic, as constitutional factor, 567
relation of weight to, 569
Breast, human, vitamin D potency of, 298 (Abst.)
Bridgework, children's, prevents crooked teeth, 259
Brush foundation continues, 195
Busby, Oscar E., in memoriam, 101

C

Calcification of stylo-mandibular ligament, 812

Camera, miniature, and cephalo-phore, use of, for standardized facial and dental photographs, 139

Cancer of lip, 1181
current treatment of, 1011 (Abst.)

Care, physiologic, of preschool child, 508 (Abst.)

Caries, dental, and nutritional state, diet of adolescent girls, with reference to, 297
development of, in teeth of albino rats following extirpation of salivary glands, 88
susceptibility, high, in diminished salivation, 1102

Case report, 89, 188, 290, 394, 503, 602, 712, 812, 916, 1002, 1102

Cases, dental surgical, management of various types of, 64

Casts, method for making oriented, and recording dentofacial changes, 941

Cementum, alveolar bone, and eruption of rat molar, studies in, 854

Central association of orthodontists, 307, 1219

Cephalographics, standardized x-ray, 725

Cephalo-phore and miniature camera, use of, for standardized facial and dental photographs, 139
description of, 141
procedure in using, 143

Cephalostat, adjustable x-ray, 725
central x-ray director, 728

Certificates of proficiency in orthodontics, receivers of, 1113

Changes, dentofacial, method for recording, and for making oriented casts, 941
in bone, resulting from experimental orthodontic treatment, 521
morphologic, of maxillary and mandibular arches, 208

Cheek, noma of, 290

Chicago association of orthodontists, 103, 200, 305
dental society, 105, 1219

Child development and guidance told in pictures, 818 (B. rev.)
preschool, physiologic care of, 508 (Abst.)

Children, adolescent, postrachitic and nonrachitic, malocclusion in, 1119

Chin, formation of, and shedding of teeth, growth of mandible during, critical remarks relating to, 293 (Abst.)
retarded, correction by plastic operation, 1106 (Abst.)

Chlorosis, 70

Chrome alloy, use of, 875
used in retentive measures, 37

Class III, treatment of, 346

Cleft lip, cleft palate, congenital, and associated nasal deformities, 401 (Abst.)
palate, partially, double elongation of, and elongation of palate with complete cleft, 910

Cleido-cranio-facial dysostosis, report of two cases of, 397 (Abst.)

Committee on dental preparedness, 1220

Complications and treatment in fractures of maxillary bones, 162
postoperative, following removal of mandibular third molar, 278

Congenital absence of ramus of mandible, 175

Constitution and failure, 573

Costen's syndrome, 388

Cranial osteomas, from roentgenologic viewpoint, 1199

Crossbreeding of contrasted types of dogs, 627

Cyst, mandibular, with infections, 188
vs. apical infection, 684

Cysts, median anterior maxillary, 60
of jaws, 690
types of, 690

D

Deane, Harry Tennison, in memoriam, 409

Defense program, place of dentistry in, 1074

Deficiencies bringing about medico-dental problems, 1146

Deformities, nasal, and congenital cleft lip, cleft palate, 401 (Abst.)

Dental caries and vitamin C, relation between, 192 (Abst.)
centenary celebration, scientific sessions, 201

Denti-phore, method for making oriented casts and recording dentofacial changes, 941

Dentistry, anatomic principles as applied to, 1006 (Abst.)
and national defense, 1074
military, place of orthodontics in, 313
restorative, orthodontics as supplement to, 320
use and application of analysis of articulate sounds in art and science of, 1
1939 year book of, 399 (Abst.)

Dentition and face, development of, in application to orthodontic treatment, 424
deciduous, eruption of, 209

Dento-medical problems, 1146

Denture, developmental growth of face in relation to, 234

Dentures, full, construction and adaptation of, immediately following extraction of teeth, 276

Development and growth, effect of mastication on, 669

Development and growth—cont'd
and growth, facial, factors contributing to, 1019, 1027, 1036
of teeth and jaws, 829
physical, and growth, study of, 759
Diagnosis and treatment of lesions of temporomandibular joint, 374
of cancer of lip, 1181
Dictionary of foods and nutrition, 195 (B. rev.)
Stedman's medical, with etymologic and orthographic rules, 610 (B. rev.)
Diet, comparison of primitive and modern, and effect of, 194 (B. rev.)
deficient, appearance of skeletal abnormalities in offspring of rats reared on, 1213 (Abst.)
of adolescent girls, with special reference to nutritional state and dental caries, 297 (Abst.)
treatment by, 194 (B. rev.)
Dilantin hyperplasia of gingivae, 394
sodium, hypertrophy of gums due to administration of, 908
Directory, orthodontic, of world, 399 (Abst.)
Diseases, constitutional, in prognosis of orthodontic treatment, 955
surgical, of mouth and jaws, 300 (B. rev.)
Dislocations and subluxations of temporomandibular joint, 384
Displacement, distal, of lower arch, by means of intermaxillary rubber bands, 529
Distoclusion with protraction of maxillary incisors, 597
Dogs, crossbreeding in contrasted types of, 627
Drugs, therapeutic values of, 361
Dysostosis, cleido-cranial-facial, report of two cases of, 397 (Abst.)
Dysplasia, ectodermal, anodontia in, 503
Dystrophies, muscular, and allied conditions, treatment of, 813 (Abst.)

E

Eastern association of graduates of Angle school of orthodontia, contribution of, to science and practice of orthodontics, 398 (Abst.)
Effects of maxillary impacted third and fourth molars on ciliary nerves of eye, 712
of natural and refined sugars on oral lactobacilli and caries among primitive Eskimos, 715 (Abst.)
of symmetrical extraction of six-year molars, 815 (Abst.)
Elongation, artificial, of teeth, 931
of partially cleft palates and palates with complete clefts, 910
Enamel formation, abnormal, histopathologic studies of, in human teeth, 1083
maintenance of integrity of, during orthodontic treatment, 1138
Enamel—cont'd
of teeth, cases of brown coloration of, in three siblings, 191 (Abst.)
of teeth, human, 918 (Abst.)
Endocrine glands, 97 (B. rev.)
Endocrines, influence of, on teeth and jaws, 671
Eruption, alveolar bone, and cementum of rat molar, studies in, 854
Etiology of malposed third molars, influences in, 295 (Abst.)
Exodontia, influence of George B. Winter on development of, 285
Extraction, indicated constitutionally, 574
of six-year molar during childhood, 608 (Abst.)
of teeth for treatment, osteomyelitis of jaws following, importance of histologic picture of, 150
premature, and space retainer, 577
symmetrical, of six-year molars, effects of, 815 (Abst.)
Eye, ciliary nerves of, effect of maxillary impacted third and fourth molars on, 712

F

Face and dentition, development of, in application to orthodontic treatment, 424
developmental growth of, in relation to denture, 234
growth of, proportionality in, 751
recent observations on, and implications to orthodontist, 741
plastic surgery of, 961
Facial paralysis, management of, by physical measures, 922 (Abst.)
utilization of temporal muscle and fascia in, 80
Factor, constitutional, in skull form and dental occlusion, 627
Factors contributing to facial growth and development (Symposium), 1019, 1027, 1036
Failure, related to constitutional factors, 573
Fascia and temporal muscle, utilization of, in facial paralysis, 80
Fibro-osteoma (osteitis fibrosa localizata) clinically and radiographically resembling Ewing's tumor, 1002
Finger-sucking, as etiologic factor in malocclusion, 216
malocclusion accompanied by distortion of fingers, as result of, 242
Fistula, facial, of dental origin, 797
Five-state postgraduate clinic, 1219
Food, effect of, on mastication, 667
Form of skull, and dental occlusion, constitutional factor in, 627
Fractures of temporomandibular joint, 383
pathologic, of mandible, predisposed by osteomyelitis, 896
treatment of, 299 (B. rev.)

Frenum labii superioris, 192 (Abst.)
Fruits, citrus, effect of, in treatment of hemorrhagic condition, 987

G

Genetics, mammalian, 1214 (Abst.)
Gingivae, dilantin hyperplasia of, 394
Gingival disease, agents used in treating, 362
Gland, endocrine, 97 (B. rev.)
  parotid, contribution to pathology and treatment of intermittent swelling of, 923 (Abst.)
  pituitary, anterior lobe of, interrelation between vitamin B complex and, 1011 (Abst.)
  salivary, development of caries in teeth of albino rats following extirpation of, 88
    tumors of, 95 (Abst.)
Great Lakes association of orthodontists, 826, 929, 1115
    president's address, 1117
Grisamore, Thomas L., in memoriam, 197
Growing perfect teeth, 356
Growth and development, effect of mastication on, 669
    factors contributing to, 1019, 1027, 1036
    of dental arches in children, 1105 (Abst.)
    of teeth and jaws, 829
    physical, study of, 759
  individual patterns of, 751
  in mandible during shedding of teeth and formation of chin, critical remarks relating to, 293 (Abst.)
  of face, developmental, in relation to denture, 234
    proportionality in, 751
    recent observations on, and implications to orthodontist, 741
  pattern and teeth, 753
Growths, bony, on jaws, 1010 (Abst.)
Gum pads, anatomy of, 208
Gums, hypertrophy of, due to administration of dilantin sodium, 908

H

Hawley retainer, use of, in retentive procedures, 38
Head roentgenograms, lateral, and their relation to orthodontic problem, 768
Health, record of, 758
Hemorrhage, control of, 982
  postoperative treatment of, 989
  systemic treatment of, 992
Hunter, John, and his natural history of human teeth, 246
Hydro-colloidal impression material, use of, in orthodontics, 228
Hyperplasia, dilantin, of gingivae, 394
  epithelial, 494
Hypoplasia, congenital, of mandible, 716 (Abst.)

I

Incisor, absence of one peg lateral and one lateral, 465
Incisors, maxillary, distoclusion with protraction of, 597
Infection, apical vs. cyst, 684
  mandibular cyst with, 188
Inflammation, types of, 361
Influence of endocrines on teeth and jaws, 671
  of moving deciduous teeth on permanent successors, 1152
In memoriam, Ashplant, Percy Roy, 407
  Busby, Oscar E., 101
  Deane, Harry Tennison, 409
  Grisamore, Thomas L., 197
  McPhail, John A., 198
  Stilley, Van A., Jr., 198
  Van Gieson, Ransford B., 102
  Winter, George B., 515

J

Jaw, and mouth, surgical diseases of, 300 (B. rev.)
  and teeth, influence of endocrines on, 671
  bony growths on, 1010 (Abst.)
  lateral x-rays of, 734
Jaws, cysts of, 690
  osteomyelitis of, 584
Jaw-winking, Marcus Gunn phenomenon, 191 (Abst.)
Johnson, Dr. A. LeRoy, receives honorary membership, 104
Jumping bite, 526

L

Labiolingual technique, 609 (B. rev.)
Latex rubber as orthodontic aid, 353
Lesions of temporomandibular joint, diagnosis and treatment of, 374
Let's talk about your baby, 818 (B. rev.)
Letter, open, to editor, 615
Leucemia, 73
  acute aleucemic, 89
  lymphatic, 74
  myelogenous, 75
  oral manifestations in, 901
Leucokeratosis, 492
Leucoplakia, studies in, 492
  treatment of, 501
Ligament, stylo-mandibular, calcification of, 812
Limitations, constitutional, of treatment, 572
Lingual arch, philosophy of treatment with, 330
    use of hydro-colloidal impression material, in constructing, 230
Lip, cancer of, 1181
    current treatment of, 1011 (Abst.)

M

Malformations, congenital, in families, frequency of, 298 (Abst.)

Malocclusion, accompanied by distortion of fingers, as result of finger-sucking, 242
aspects of prevention of, 1009 (Abst.)
how early may it be recognized? 224
in group of postrachitic children and nonrachitic adolescent children, 1119
is thumb- or finger-sucking etiologic factor in? 216
Mammalian genetics, 1214 (Abst.)
Management of various types of dental surgical cases, 64
Mandible, congenital hypoplasia of, 716 (Abst.)
growth and development of teeth in, 829
pathologic fractures of, predisposed by osteomyelitis, 896
ramus of, congenital absence of, 175
surgical treatment of, 182
Mandibular cyst with infections, 188
mixed tumor of salivary type, 602
resection, 793
Massachusetts dental society, 200, 305, 1114
Mastication, effect of food on, 667
on growth and development, 669
muscular activity of, method of measuring, 714 (Abst.)
physiology of, 664
stresses of, 666
Masticatory apparatus, human, cinefluorographic study of, 664
Material, hydro-colloidal impression, use of, in orthodontics, 228
Maxilla, growth and development of teeth in, 829
Maxillary bones, treatment and complications in fractures of, 162
McCoy open tube, used to bring about tooth movement, 779
McPhail, John A., in memoriam, 198
Measurements, correction of, on cephalometric x-rays, 743
Medico-dental problems, 1146
Metal alloys, precious, study in tempering, 29
Method for making oriented casts and recording dentofacial changes, 941
of determining bleeding and clotting time, 987
of making snap-channel, tie-lock attachment, 1046
of measuring muscular activity of mastication, 714 (Abst.)
of procuring head roentgenograms, 768
skull and chin-cap, case treated by, 94 (Abst.)
Methods of administering local anesthesia, 805
of treatment or appliances, biometric norm values as basis for choice of, 1052
Mexican association of orthodontists, 1220
Mid-continent dental congress, 929
Molar, first, submerging, report of case of, 681
Molar—cont'd
malposed third, influences in etiology of, 295 (Abst.)
mandibular third, postoperative complication following removal of, 278
maxillary impacted third and fourth, effect of, on ciliary nerves of eye, 712
rat, quantitative studies in development of, 854
six-year, effects of symmetrical extraction of, 815 (Abst.)
extraction of, during childhood, 608 (Abst.)
Molasses in anemia, 192 (Abst.)
Mouth and jaws, surgical diseases of, 300 (B. rev.)
bactericidal and bacteriostatic agents in, study of comparative efficiency of, 968
Muscle, temporal, and fascia, utilization of, in facial paralysis, 80
Myofunctional treatment from practical standpoint, 1131

N

National defense and dentistry, 1074
Nerves, ciliary, of eye, effect of maxillary impacted third and fourth molars on, 712
Neutroclusion, with one peg lateral incisor and one lateral incisor missing, 465
News and notes, 103, 200, 305, 411, 516, 621, 722, 825, 928, 1016, 1113, 1219
New York society of orthodontists, 103, 200, 1113
president's address, 419
Noma of cheek, 290
Norm values, biometric, as basis for choice of appliances or methods of treatment, 1052
Notes of countryman, 400 (Abst.)
Noyes, F. B., retires as dean, 928
Nutrition and physical degeneration, comparison of primitive and modern diets and their effects, 194 (B. rev.)
promise of, 448

O

Occlusion, dental, and skull form, constitutional factor in, 627
effect of breast or bottle feeding on, 216
from birth to three years, serial study on, 207
inferior postnormal, contribution to study of, 1121 (Abst.)
three-dimensional consideration of, 787
Officers of orthodontic societies, 106, 206, 308, 418, 520, 622, 724, 828, 930, 1018, 1116, 1222
Operation, plastic, for correction of retruded chins, 1106 (Abst.)

Operation—cont'd
utilizing temporal muscle and fascia in facial paralysis, 81
Oral cavity and saliva, studies of, 41
manifestations in blood dyscrasias, 67
of leucemia, 901
phonetic curve, 3
surgical conditions and their treatment, 1195
Orthodontic aid in periodontia and prosthesis, 93 (Abst.)
directory of world, 399 (Abst.)
office, description of, 1014
photographic recorder, 139
problems, constitutional aspects of, 566
results many years after treatment, 843
teaching and investigation and primary dental concern, trend of, 130
theories, critical review of, 47
treatment, development of face and dentition in its application to, 424
experimental, bone changes resulting from, 521
maintenance of enamel integrity during, 1138
time to begin, 548, 556
Orthodontics, American board of, work of, 57
as supplement to all restorative dentistry, 320
in Latin America, status of, 1067
its place in military dentistry, 313
latex rubber as aid in, 353
practical thoughts on, 881
public relations bureau leaflet on, 149
relation to present social trend, 338
relationship to pediatrics, 325
use of hydro-colloidal impression material in, 228
Osteitis fibrosa localizata, clinically and radiographically resembling Ewing's tumor, 1002
Osteomas of cranium, from roentgenologic viewpoint, 1199
Osteomyelitis of jaws, 584
following extraction of teeth for treatment, importance of histologic picture of, 150
predisposing factor in pathologic fractures of mandible, 896

P

Pacific coast society of orthodontists, 103, 104
Palate, abnormalities of, treated by surgery, 263
with complete cleft, elongation of, and double elongation of partially cleft palate, 910
Paralysis, facial, management of, by physical measures, 922 (Abst.)
results of facio-hypoglossal anastomosis in treatment of, 816 (Abst.)
utilization of temporal muscle and fascia in, 80
Paresthesia, following removal of third molar, 278
Pediatrics, relationship to orthodontics, 325
Perimylolysis, contribution of genesis of tooth wasting from nonmechanical causes, 191 (Abst.)
Photographs, standardized facial and dental, use of cephalo-phore and miniature camera for, 139
Physiology in health and disease, 511 (B. rev.)
of mastication, 664
outline of, 1214 (Abst.)
textbook of, 610 (B. rev.)
Picture, histologic, of osteomyelitis of jaws following extraction of teeth for treatment, 150
Plates used in raising bite, 532
Polycythemia, 72
President's address, American association of orthodontists, 623
Great Lakes society of orthodontists, 1117
New York society of orthodontists, 419
Southwestern society of orthodontists, 309
Principles, anatomic, as applied to dentistry, 1006 (Abst.)
Problems, mechanical and histologic, in rotation of teeth, 606 (Abst.), 921 (Abst.)
orthodontic, constitutional aspects of, 566
lateral head roentgenograms and relation to, 768
social, and sociology, introduction to, 611 (B. rev.)
Procedure for taking cephalic x-rays, 731
in retention, 37
operative, in resection of mandible, 793
surgical, notes on, in orthodontic treatment, 814 (Abst.)
Profiles, hard and soft tissue, advantages of obtaining simultaneously, 771
Kretschmer types of, 569
Prophylaxis in cancer of lip, 1181
Protraction of maxillary incisors, distoclusion with, 597
Psychology, child, for professional workers, 611 (B. rev.)
Public relations bureau news, 415
prepares new leaflet on orthodontics, 149
committee, report of, 891
Purpura, 77

R

Radiograms, positioning for correct anglization in, 600
Ramus of mandible, congenital absence of, 175
Record of health, 758
Recorder, orthodontic photographic, 139

Removal, extraoral, of root displaced by gunshot wound, 391
Report of American Board of Orthodontics, 889
of public relations committee, 891
Resection of mandible, 793
Results of facio-hypoglossal anastomosis in treatment of facial paralysis, 816 (Abst.)
of use of sliding yoke, 24
orthodontic, many years after treatment, 843
Retainer, Hawley, use of, in retentive procedures, 38
space, and premature extraction, 577
Retention procedures, 37
Review, critical, of some orthodontic theories, 47
Ridges, deformed, operation to restore, 267
Roentgenograms, comparison of, to determine changes incident to treatment, 774
head, method of procuring, 768
lateral head, and their relation to orthodontic problem, 768
profile, interpretation of, 772
Roentgenology, clinical dental, technique and interpretation including roentgen studies of child and young adult, 510 (B. rev.)
Root displaced by gunshot wound, removed extraorally, 391
Rotation of teeth, mechanical and histologic problems in, 606 (Abst.)
Rubber, latex, as orthodontic aid, 353

S

Saliva and oral cavity, studies of, 41
Salivary glands, extirpation of, development of caries in teeth of albino rats, following, 88
tumors of, 95 (Abst.)
Salivation, diminished, high caries susceptibility in, 1102
Scurvy, 76
Silver-tin, bite planes made of, 816 (Abst.)
Skin, transplantation of, within oral cavity, 275
Skull form and dental occlusion, constitutional factor in, 627
Snap-channel, tie-lock attachment, method of making, 1046
Social trend, relation of orthodontics to, 338
Sociology and social problems, introduction to, 611 (B. rev.)
Solutions used in local anesthesia, 808
Sounds, analysis of articulate, and use and application in art and science of dentistry, 1
Southern society of orthodontists, 200, 305
Southwestern society of orthodontists, 103, 306, 1219
president's address, 309
Space, anterior, between gum pads, future significance of, 210
Speech, division of sounds of, 4
physiologic, psychologic, and anatomic phases of, 2
Splint, used in fracture of maxillary bones, 164
Steel, stainless, 190 (Abst.)
alloys, 1214 (Abst.)
Stilley, Van A., Jr., in memoriam, 198
Stresses of mastication, 666
Studies, histopathologic, of abnormal enamel formation in human teeth, 1083
in leucoplakia, 492
of oral cavity and saliva, 41
quantitative, in development of rat molar, 854
Study, cinefluorographic, of human masticatory apparatus in function, 664
in tempering precious metal alloys, 29
of comparative efficiency of bactericidal and bacteriostatic agents in mouth, 968
serial, on occlusion from birth to three years, 207
Subluxations and dislocations of temporomandibular joint, 384
Sugars, natural and refined, effects of, on oral lactobacilli and caries among primitive Eskimos, 715 (Abst.)
Surgery of injury and plastic repair, 400 (Abst.)
pediatric, 97 (B. rev.)
plastic, of face, 961
Symbols, dental, revision of, 94 (Abst.)
Symposium on bite planes, 107, 120, 125

T

Teaching, orthodontic, and investigation as primary dental concern, trend of, 130
Technique, labiolingual, 609 (B. rev.)
of impression taking in infants, 208
Teeth and growth pattern, 753
and jaws, influence of endocrines on, 671
anomalies of shapes and number of, and question of hereditary significance, 190 (Abst.)
artificial elongation of, 931
crooked, children's bridgework prevents, 259
deciduous, influence of moving, on permanent successors, 1152
extraction of, osteomyelitis of jaws following, 150
growing perfect, 356
human, enamel of, 918 (Abst.)
histopathologic studies of abnormal enamel formation in, 1083
natural history of, John Hunter on, 246
mechanical and histologic problems in rotation of, 921 (Abst.)

Teeth—cont'd
permanent, influence of moving deciduous teeth on, 1152
rotation of, mechanical and histologic problems in, 606 (Abst.)
shedding of, and formation of chin, growth of mandible during, critical remarks relating to, 293 (Abst.)
thirteen impacted and unerupted, in one mouth, 916
treatment requiring tipping and bodily movement of, 779
Tempering precious metal alloys, study in, 29
Temporomandibular joint, ankylosis of, 385
arthritis of, 377
dislocations and subluxations of, 384
fractures of, 383
lesions of, 374
diagnosis and treatment of, 374
Tests, preoperative, evaluation of, for anesthetics, 473
Therapeutics, logical approach to, 360
Therapy, vitamin, present status of, 1178
Thumb-sucking as etiologic factor in malocclusion, 216
Tissue, periodontal, ability of orthodontic appliances to traumatically compress, 51
Todd, T. Wingate, remarks at presentation of portrait of, to Western Reserve University, 618
Tooth deficiencies, nutrition in, 451
Transplantation of skin, within oral cavity, 275
Treatment and complications in fractures of maxillary bones, 162
and diagnosis of lesions of temporomandibular joint, 374
by diet, 194 (B. rev.)
constitutional limitations of, 572
current, of cancer of lip, 1011 (Abst.)
extraction of teeth for, histologic picture of osteomyelitis of jaws following, 150
methods of, or appliances, biometric norm values as basis for choice of, 1052
myofunctional, from practical standpoint, 1131
of cancer of lip, 1181
of case by skull and chin-cap method, 94 (Abst.)
of Class III, 346
of facial fistulas of dental origin, 797
of fractures, 299 (B. rev.)
of leucoplakia, 501
of median anterior maxillary cysts, 62
of muscular dystrophies and allied conditions, 813 (Abst.)
of oral surgical conditions, 1195
of osteomyelitis of jaws, 586
operative, of adamantinoma, 490
orthodontic, constitutional diseases in prognosis of, 955
Treatment, orthodontic, cont'd
development of face and dentition in its application to, 424
experimental, bone changes resulting from, 521
maintenance of enamel integrity during, 1138
notes on surgical procedure in, 814 (Abst.)
results many years after, 843
time to begin, 548, 556
postoperative, of hemorrhage, 989
requiring tipping and bodily movement of of teeth, 779
surgical, of abnormalities of edentulous alveolar processes and palate, 263
of mandible, 182
systemic, of hemorrhage, 992
using bite planes, 108
with lingual arch, philosophy of, 330
Tube, McCoy open, used to bring about tooth movement, 779
Tumor, Ewing's, fibro-osteoma clinically and radiographically resembling, 1002
mandibular mixed, of salivary type, 602
of salivary glands, 95 (Abst.)
Types, facial, 566
of cysts, 690

U

Use of bite planes, 108, 120, 125
of cephalo-phore and miniature camera for standardized facial and dental photographs, 139
of hydro-colloidal impression material in orthodontics, 228
of latex rubber in orthodontics, 353
results of, of sliding yoke, 24
Utilization of temporal muscle and fascia in facial paralysis, 80

V

Van Gieson, Ransford B., in memoriam, 102
Vitamin B complex, and anterior lobe of pituitary gland, interrelation between, 1011 (Abst.)
C and dental caries, relation between, 192 (Abst.)
D potency of human breast, 298 (Abst.)
therapy, present status of, 1178

W

Washington-Baltimore society of orthodontists, 105, 205, 1115
Weight in relation to bizygomatic breadth, 569
Winter, George B., influence of, on development of exodontia, 285
in memoriam, 515
Wound, gunshot, extraoral removal of root displaced by, 391

X

X-ray cephalographics, standardized, 725
negatives, cephalic, projection and tracing of, 735

X-rays, cephalic, procedure for taking, 731
superimpositions of, on nasion-basilar cranial base, 739
lateral, of jaw, 734

Y

Yoke, sliding, results of use of, 24

EDITORIALS

An Orthodontic Institution Devoted to Advance and Service, 1217
Comments on "Limitations of Treatment," 613
Dentistry to Mobilize, 1110
Future Research, 1012
George B. Winter, 515
Head and Face Surgery Units, 819
Limitations of Treatment, 403
Orthodontic Safety-First Theme, 925
Orthodontics in Retrospect, 1111
Oscar Busby, 99
Our Twenty-Fifth Birthday, 99
Remarks of Dr. George W. Grieve in Accepting the Ketcham Award, 926
Report of the Chicago Meeting of the American Association of Orthodontists, 1940, 720
Stamps and Anesthesia, 301
Straws in the Wind, 405
The American Dental Association and Its Dues, 302
The Dental Centenary Celebration, 196
The Ketcham Award Is Conferred Upon Dr. George Grieve of Toronto, Canada, 820
The Wuerpel Influence in Orthodontics, 1216

• THE ANACIN COMPANY • JERSEY CITY, N. J. •

American Journal of Orthodontics and Oral Surgery

CONTENTS FOR DECEMBER, 1940

Orthodontics

President's Address. Great Lakes Society of Orthodontists. Lieut.-Col. Harvey G. Bean, L.D.S., D.D.S., Toronto, Can. ---- 1117

Malocclusion in a Group of Postrachitic and Nonrachitic Adolescent Children. Bert G. Anderson and Veikko O. Hurme, New Haven, Conn. ---- 1119

Myofunctional Treatment From a Practical Standpoint. Alfred P. Rogers, D.D.S., A.M., Boston, Mass. ---- 1131

The Maintenance of Enamel Integrity During Orthodontic Treatment. Harold K. Box, D.D.S., Ph.D., Toronto, Can. ---- 1138

Medico-Dental Problems. William V. Watson, M.B., Toronto, Can. ---- 1146

The Influence of Moving Deciduous Teeth on the Permanent Successors. Carl Breitner, M.D., New York, N. Y. ---- 1152

The Present Status of Vitamin Therapy. Frederick F. Tisdall, M.D., F.R.C.P. (C.), Toronto, Can. ---- 1178

Department of Oral Surgery and Pathology

Cancer of the Lip. A Consideration of Its Prophylaxis, Diagnosis, and Treatment. Howard B. Hunt, M.A., M.D., Omaha, Neb. ---- 1181

Oral Surgical Conditions and Their Treatment. Joseph A. Doherty, D.M.D., B.S., M.S., Boston, Mass. ---- 1195

Cranial Osteomas, From a Roentgenologic Viewpoint. Charles Wadsworth Schwartz, M.D., New York, N. Y. ---- 1199

Department of Orthodontic Abstracts and Reviews

Orthodontic Abstracts and Reviews ---- 1211

Editorials

The Wuerpel Influence in Orthodontics ---- 1216

An Orthodontic Institution Devoted to Advance and Service ---- 1217

News and Notes

News and Notes ---- 1219

Officers of Orthodontic Societies ---- 1222

Index ---- 1223

Oralium Band Material

ALL THE ADVANTAGES OF PURE PLATINUM WITH THE STRENGTH AND DURABILITY OF ORALIUM

BECAUSE pure platinum is completely immune to the action of mouth secretions and never develops oxides during annealing and soldering, it would be the one perfect material for orthodontic bands, if it had the other indispensable qualities, but it hasn't.

Just the same, you can secure the advantages of pure platinum and still have bands with all the necessary attributes. Oralium Band Material is just this happy combination with its surfaces of pure platinum, so securely welded to an Oralium body that the two have become practically one piece of metal. Oralium is the precious metal alloy which has been used for so many years to construct literally tens of thousands of prosthetic cases. So, even if you grind through the platinum, you expose nothing but tarnish-resistant precious metal.

The principle involved in Oralium Band Material is the same as in Baker Platinum-Clad used in the chemical industries for making chemical apparatus—pure platinum securely welded to one or both faces of another metal. In the chemical process industries, such apparatus must resist the action of powerful acids and other agents. Can anything be sounder than the application of this principle to orthodontic use?

BAKER & CO., INC.
113 Astor St., Newark, N. J.

30 CHURCH ST. NEW YORK
55 E. WASHINGTON ST., CHICAGO
760 MARKET ST. SAN FRANCISCO

WORTH INVESTIGATION!

The Possibilities of Greater Service With the Use of the DEE HEATREAT UNIT

Use DEEPEP Wire In Its Softest Form (Bright Annealed) . . . And the DEE HEATREAT UNIT

The New DEE Heatreat Unit which eliminates "shorting" through spills. Price: $5.50. A special unit is available to care for higher platinized alloys. Complete details on request.

For extra speed, extreme accuracy and uniformity in constructing an appliance use DEEPEP wire (bright annealed). Then immerse the appliance in the DEE HEATREAT UNIT for twenty minutes to secure the maximum toughness and physical efficiency. Literature giving all details will be sent on request.

THOMAS J.

DEE & CO.

Precious Metals

GENERAL OFFICES AND PLANT
1900 W. KINZIE ST.

CHICAGO

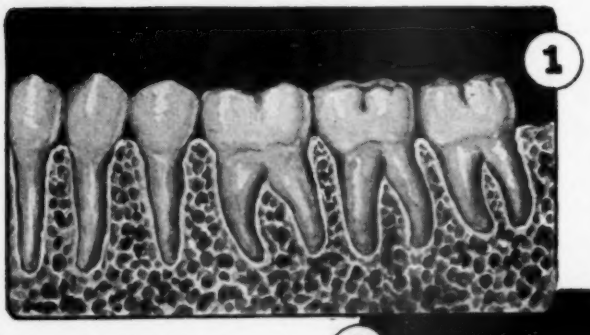
DOWNTOWN OLD GOLD AND SALES OFFICE
55 E. WASHINGTON ST.

DEEPEP WIRE

With Controlled Spring Back . . . Insures Gentle Pressure

And that is mighty important as all Orthodontists know. Because an appliance made with DEEPEP wire moves the tissue no faster than nature's supporting processes can make adjustment. As a result greater accuracy is obtainable . . . much to the satisfaction of the patient and the Orthodontist.

THOMAS J.
DEE & CO.
Precious Metals
GENERAL OFFICES AND PLANT 1900 W. KINZIE ST.
CHICAGO
DOWNTOWN OLD GOLD AND SALES OFFICE 55 E. WASHINGTON ST.



1 Teeth solidly held in normal alveolar bone. Accompanying graph shows the closely similar number of phosphatase units in plasma from the finger tip and in plasma from gingival tissues adjacent to the alveolar crest.

2 Teeth insecurely held because of "rapid" type of alveolar crest destruction (*S. C. Miller Classification*) Graph shows that phosphatase content of plasma taken from gingival tissue adjacent to area of bone dissolution is appreciably higher than in finger tip plasma.

Relation OF PHOSPHATASE TO *ORAL HEALTH* SOUGHT BY NEW INVESTIGATIONS

A recent dental university study shows that in alveolar bone destruction (a cause of loosening and loss of teeth) plasma phosphatase values in the vicinity of the pathology are markedly higher than in the general circulation. Such biochemical findings, it is believed, will prove valuable to future research which attempts to find a means of alleviating this condition as a step toward improved dental and oral health. A report of this study will be sent to any interested dentist.

THIS AND OTHER SCIENTIFIC RESEARCH IN PROBLEMS OF ORAL HEALTH IS SPONSORED BY FELLOWSHIPS OF

BRISTOL-MYERS COMPANY

Makers of Ipana

The Scientific Tooth Paste

for Tooth Cleansing and Gum Massage

19-K West 50th St. • New York, N. Y.

DICALCIUM PHOSPHATE COMPOUND WITH VIOSTEROL SQUIBB supplies calcium, phosphorus and Vitamin D in therapeutically effective quantities. These three factors are necessary for increased bone development and are therefore useful as an adjunct in orthodontic procedures. In the opinion of many authorities, these elements also play an important part in the maintenance of normal teeth.

Since children's appetites are often capricious, their diet may be deficient in calcium. To overcome such a deficiency, many dentists recommend a dietary supplement such as Dicalcium Phosphate Compound with Viosterol Squibb. Children like the Tablets, for they are flavored with wintergreen and have a very pleasant taste.

Each Tablet Dicalcium Phosphate Compound with Viosterol supplies 2.6 grains calcium, 1.6 grains phosphorus and 660 U.S.P. XI units of Vitamin D. The product is also supplied in capsule form—two capsules being equivalent to one tablet.

Tablets Dicalcium Phosphate Compound with Viosterol Squibb are supplied in boxes of 51 and 250—the capsules in bottles of 100 and 1000. One tablet (or two capsules) three times daily will meet the usual requirements of children undergoing orthodontic treatment.

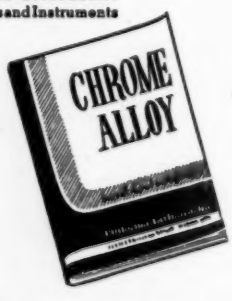
For literature address the Dental Dept., E. R. Squibb & Sons, 745 Fifth Ave., New York

SQUIBB
Dicalcium Phosphate Compound with Viosterol
TABLETS · · · CAPSULES

EVERYTHING for the ORTHO

BE GOOD TO YOURSELF . . .
Save both nervous and physical energy by letting the spring tension of the welder hold the parts to be joined while you check their relation and touch the switch which unites them into one solid piece. Save your eyes the strain of watching detail against the light of a flame. Use of Tru-Chrome eliminates the waste motion of fluxing and pickling because the weld is instantaneous and clean. Let Tru-Chrome and welding help you attain your maximum in years of service to the profession.

WRITE FOR OUR new catalog showing the complete line of Rocky Mountain Orthodontic Materials and Instruments

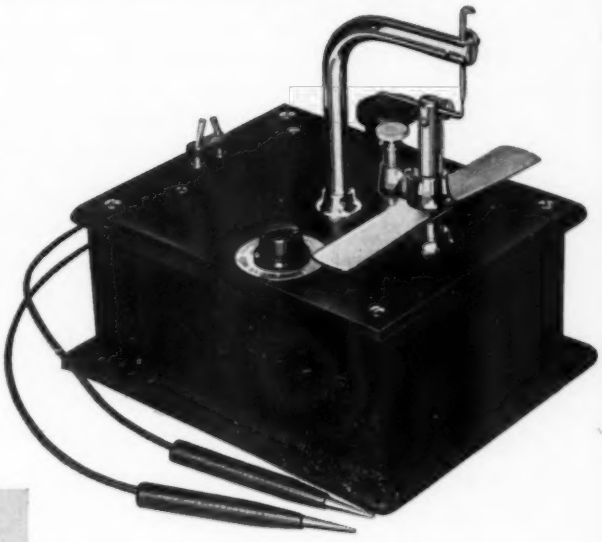


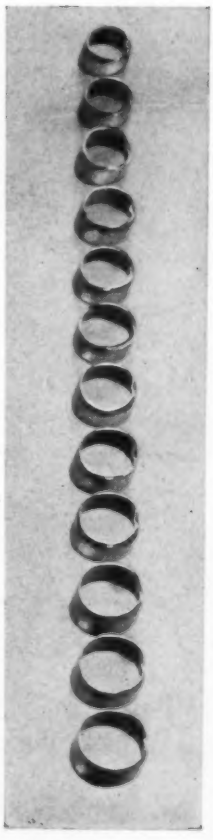
Rocky Mountain Metal Products, Inc.
1275 Sherman Street • Box 183 • Denver, Colorado

DONTIST

THE TRU-SPOT WELDER

is simple and easy to operate, yet it fuses the parts to be joined into one piece — a permanent union. In addition, it is economical to operate since its use requires no solder or flux and there are no moving parts which can wear out.





TRU-FORM SEAMLESS ANCHOR and INCISOR BANDS

Protect your patient with Tru-Form bands for molars and incisors. Insure a perfect fit with a skillfully contoured seamless band which is thin and adaptable, yet superbly strong. The velvet finish interior secures a vise-like cement grip on the tooth, while the highly polished, resistant exterior guarantees maximum cleanliness. Available in complete sizes. Tru-Form bands will save you time and money.

Pacific Coast Distributor
KARL A. KREIS
Flood Building, San Francisco

MONŐCAINE HCl

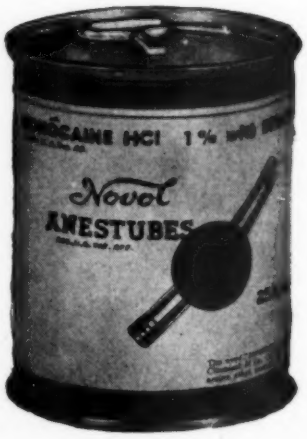
New, Potent, Local Anesthetic

Proved in the test tube and animal research in the laboratory; findings corroborated by exhaustive clinical experimentation; conspicuously successful in the crucial test of more than 17,000,000 injections at the chair—

Monőcaine HCl, the new potent local anesthetic developed in our research laboratories, now takes its place amongst the approved and accepted local anesthetics in dentistry and medicine.

Dental and medical literature of the past three years adds further evidence of the value of Monőcaine HCl. Authoritative, unbiased articles on the successful clinical use of Monőcaine HCl have appeared in a number of eminent dental and medical journals.

The authors of these articles are all in agreement that Monőcaine HCl produces profound anesthesia, and, in the concentration used, is devoid of the untoward symptoms or "jittery" reactions frequently characteristic of procaine injections.



If you are not a user of Monőcaine HCl at present, order a vacuum packed tin of Anestubes or Novampuls from your dealer and compare results.

NOVOCOL CHEMICAL MFG. CO., INC.
2921 ATLANTIC AVENUE - BROOKLYN, N. Y.
TORONTO - LONDON - BUENOS AIRES - RIO DE JANEIRO

The Efficient Dental Assistant

By ETHEL M. COVINGTON

257 Pages. Price, $2.50.

The lessons described in this book are designed to make life much easier for many dentists, relieve the first few weeks of utter confusion for many girls, and provide some new ideas and fresh enthusiasm to assistants who have been in dental offices for a number of years.

THE C. V. MOSBY COMPANY
Publishers—St. Louis, Mo.

Have you received your copy of the 75-page brochure "Citrus Fruits and Health"? You'll find a wealth of informative, authoritative material, carefully compiled and exhaustively treated. Free on request to members of the dental profession—write for it.

FLORIDA CITRUS COMMISSION
Lakeland . Florida

GRADUATE DIVISION

College of Dentistry, University of Southern California

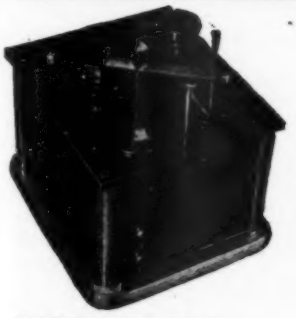
Graduate Course in Orthodontics Leading to the Degree of Master of Dental Science

The Graduate Division of the College of Dentistry, University of Southern California, announces that its next graduate course in orthodontics will begin on February 7, 1941.

The one calendar year course of full-time attendance, leading to the degree of Master of Dental Science, is the only one that will be offered at this graduate session. The one year course of full-time attendance and the two year course of half-time attendance will be offered again in 1942.

For information concerning admission requirements, scope of instruction, fees, etc., address

GRADUATE DIVISION
College *of* Dentistry, University *of* Southern California
122 E. 16th Street, Los Angeles, California



FABRICATOR OF
Chromium Alloy Attachments and Materials
for use in the technique of
THE UNIVERSAL BRACKET
and the Famous Alter Spotwelder

RET. ALTER :: P. O. Box 7 :: Pasadena, California

"ALTER products are never sold through supply houses"

THE WORD OF MOUTH ANTISEPTIC

VINCE

It speaks well for VINCE that many a prescriber first learned of this oral antiseptic by word of mouth. One dentist sees another and when they get around to talking "shop," Vince enters into the conversation. If one is unfamiliar with the preparation, the other will urge him to try it. If both are confirmed users, they compare notes on the various uses to which they put Vince. Most dentists use Vince as an all-round oral antiseptic. They prescribe it as a routine mouthwash and gargle; suggest its use in keeping dentures and appliances clean; use it as an aid in the treatment of Vincent's and other infections. ¶ You, too, can learn of the acknowledged suitability of Vince for these purposes. A trial quantity will be gladly sent you. Please write your request on your letterhead. Vince is supplied in tins of 2, 5 and 16 ounces.

Vince Laboratories, Inc., 123 West 18th Street, New York City

"MALIN'S" WILSTABRITE STAINLESS WIRE

IF NO LOCAL SUPPLY

WRITE TO US DIRECT

for use as
SOFT LIGATURE WIRE
51 Sizes—.003 to .125
HARD ARCH WIRE
56 Sizes—.003 to .250

THE MALIN COMPANY — 2515 Vestry Ave. — CLEVELAND, OHIO

New 4th Edition

TEXTBOOK *of* EXODONTIA

By LEO WINTER, M.D., D.D.S., F.A.C.D., Sc.D., LL.D., Professor of Oral Surgery, New York University College of Dentistry, etc. 520 pages, with 475 illustrations in the text and two color plates. Price, $10.00.

"Textbook of Exodontia," by Dr. Leo Winter, is a veritable "HOW" book on extractions—answering fully the perplexing questions regarding anesthesia, oral surgery and exodontia that come up almost daily in the life of the average practicing dentist. Winter tells you "HOW" to more successfully meet these daily problems. Not only does he tell you "HOW" but he illustrates "HOW"—visualizing with unusually well-defined pictures the necessary steps for each minor or major dental operation. Winter doesn't let you do an extraction without showing you each of the procedures necessary to successfully do the job. He shows you X-rays of normal and abnormal conditions. He explains the technic of anesthesia. He discusses the dangers of extractions—and finally shows you "HOW" to properly pull teeth. His book, therefore, is a complete treatise on exodontia—one that you can use as a guide in your operations with safety and assurance. New 4th edition, completely revised, now ready.

THE C. V. MOSBY COMPANY — 3525 Pine Blvd., St. Louis, Mo.

You can save **$25.00**
BY USING THE ONE LB. PACKAGE

Contains 1 lb. Powder, 1 lb. Liquid, 2 dispensing bottles, and 1 dropper. Price **$7.00**

1 oz. package contains 1 oz. Powder, 1 oz. Liquid. Price **$2.00**

Try it - **AT OUR EXPENSE!**

MAIL THIS COUPON FOR SAMPLE

A trial will show you why
MANY DENTAL COLLEGE CLINICS HAVE STANDARDIZED ON S-C CEMENT

We are so sure you'll agree with the hundreds of orthodontists who say that S-C Cement is the most satisfactory cement they can find, that we want you to try it—at our expense. That's the best way for you to appreciate what we mean when we say it is exceptionally strong, remarkably adhesive, and practically insoluble in the fluids of the mouth.

Mail the coupon today for your free sample.

STRATFORD-COOKSON COMPANY
Manufacturers of Dental Supplies
4058 Haverford Avenue • Philadelphia

Please send me my free sample of S-C Cement. I'll be very glad to try it.

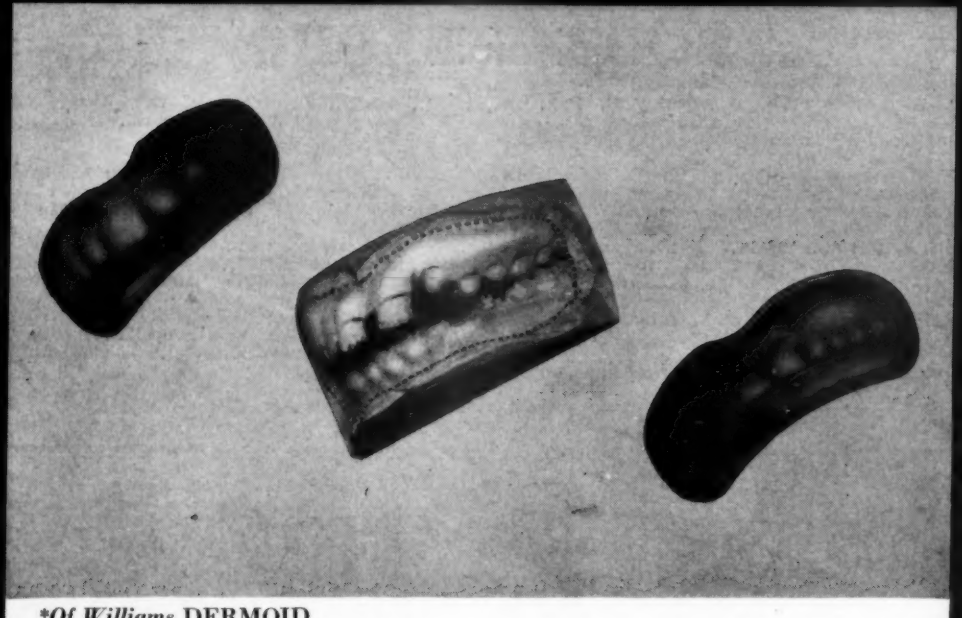
Name_____

Street_____

City & State_____

*Latex Shields**

FOR MOUTH BREATHERS



**Of Williams* DERMOID

An effective aid in the correction of mouth breathing (during the period of orthodontic treatment) is offered by latex shields of Williams Dermoid. A typical shield of this kind is illustrated above. The upper left view shows the labial surface; center shows model with dotted line indicating area covered; lower right, the dental surface.

Designed to cover both maxillary and mandibular teeth, the shield extends snugly over the buccal tissues up to the muco-buccal folds and distally to include the six year old molars.

Shields of Williams Dermoid are extremely thin, conform accurately to oral tissues and are worn with a minimum of discomfort. They are tasteless, and possess an enduring toughness. Can be cleansed daily without impairment. Two suggested techniques for producing latex rubber shields from Williams Dermoid (prevulcanized latex rubber) will be sent on request. Williams Gold Refining Co., Buffalo, N. Y. (In Canada: Fort Erie, N., Ont.)

Williams **DERMOID**

PREVULCANIZED LATEX RUBBER

*"Temperable"**
BAND METAL

If you have never used "Temperable"* Band Metal before you will be surprised at its softness and pliability in the annealed condition in which it is supplied to you.

When you have finished the construction of your appliance, and have tempered the work, you will be no less surprised at the stiffness which is imparted to your bands, even by air cooling after soldering—a stiffness without brittleness, producing that "edge strength" which is so indispensable.

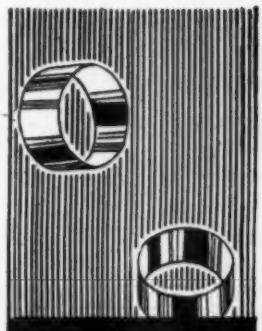
"Temperable" Band Metal derives its name from its remarkable sensitiveness to heat treatment.

Temperable Band Metal is supplied in all gauges and widths.

$1.81 per dwt.

Also in 24 sizes of seamless molar bands —average cost 48c per band. A chart of sizes will be sent on request.

* Invented by Mr. Julius Aderer, Alloy Patent No. 1,924,097.

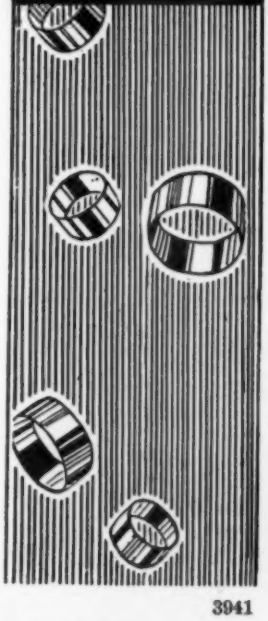


Supplied in metal in all gauges and in ready made Molar Bands in 24 sizes.

Molar Band Gauge on request.

Band Metal $1.81 Dwt.

Seamless Bands $2.01 Dwt.



3941

JULIUS ADERER, Inc.

115 W. 45TH ST., NEW YORK • 55 E. WASHINGTON ST., CHICAGO
4 COURT SQUARE, BROOKLYN • 1422 EUCLID AVE., CLEVELAND

Builders of a New World
AMERICAN
JUNIOR RED CROSS

THEORY *and* PRACTICE *of*

CROWN *and* BRIDGE PROSTHESIS

By STANLEY D. TYLMAN
Professor of Prosthetics, Head of the Department of Fixed Partial Dentures, University of Illinois College of Dentistry, Chicago

815 pages ● 1000 illustrations ● 9 color plates ● Price, $10.00

If Tylman's "Theory and Practice of Crown and Bridge Prosthesis" is not in your library, you owe it to yourself and to your patients to obtain your copy immediately. For ten years the American dental profession has been seeking a practical guide on crown and bridge work. This is the book that meets that demand—this is the book that will help you to do more crown and bridge work and improved work.

Tylman's book is comprehensive in coverage—coverage ranging from the meaning and purpose of crown and fixed partial denture prosthesis, through examination, preparation of teeth for crowns and retainers, construction of crowns, to instructions for the patient. The arrangement of the book follows the general plan of teaching this subject as recommended by the Curriculum Survey Committee of the American Association of Dental Schools, and is being accepted in many dental colleges in this country as the text for the teaching of Crown and Bridge Prosthesis.

Listed below are five good reasons why Tylman's book belongs in your library:

1. It presents the most recent advancement and teaching in connection with crown and bridge construction.

2. It contains material on casting platinum and iridio-platinum—information which is not found in any other textbook in existence today.

3. The material contained in this book is not devoted to any one particular technic, but contains and presents the fundamentals of all procedures—and the various types of restorations which are in use in general practice today. The types of restorations are not limited to those in vogue in one particular part of the country, but embrace most, if not all, of the fundamental types and processes.

4. Teachers in outstanding dental schools over the whole United States carefully went over the material critically, assuring that the contents are representative of views throughout the country.

5. The book contains a comprehensive but selected bibliography, offering the dentist and student a fine list for supplementary reading.

THE C. V. MOSBY COMPANY MJ
3525 Pine Blvd., St. Louis, Mo.

Gentlemen: Send me Tylman's "Crown and Bridge Prosthesis," priced at $10.00.

( ) Attached is my check. ( ) Charge my account.

Dr. _____

Address _____

This Christmas—be a partner in a great life-saving campaign. Use plenty of Christmas Seals on your letters and packages. They are gay, colorful . . . and what's more important . . . they spread a message of Tuberculosis control and prevention that is vital to the good health of us all!

Since 1907, the annual sale of Christmas Seals has done its share in helping to reduce the death rate from Tuberculosis by 75%! Complete eradication is now in sight! But no one is safe from Tuberculosis until *everyone* is safe. So help yourself — by helping others!

A New Book That Offers a Better Solution to YOUR *Denture Problems*

COMPLETE DENTURES

In this book Dr. Swenson clearly discusses details and illustrates procedures in the construction of varied types of prosthesis. Both chair and laboratory procedures are clearly outlined from the oral examination, through the processing of dentures, to their insertion and care. To some dentists in the past, laboratory procedures have seemed unimportant. Today, the better dentist recognizes the importance of possessing a thorough understanding of this part of his work. It has not only its economic advantages at times, but also, it is essential, to enable the dentist to direct satisfactorily the procedures if they are to be done by a technician. "Complete Dentures" gives the dentist a thorough understanding of this part of his work and provides a valuable guide to successful denture construction.

Contents

Part I—Construction of Complete Dentures

Part II—Immediate Denture Construction

Part III—Related Factors of Complete Denture Construction

Part IV—Supplemental Procedures and Materials

Part V—Single Maxillary Dentures, Duplication, and Rebasing.

By

MERRILL G. SWENSON, Professor of Prosthetic Dentistry, New York University College of Dentistry. With the Collaboration of Vincent R. Trapozzano, Associate Professor of Prosthetic Dentistry, New York University College of Dentistry.

736 pages, 905 Illustrations, 10 in Color. PRICE, $10.00.

THE C. V. MOSBY COMPANY MJ

3525 Pine Blvd., St. Louis, Mo.

Gentlemen: Send me Swenson's "Complete Dentures" priced at $10.00.

( ) Attached is my check. ( ) Charge my account.

Dr. _____

Address _____

American Journal of Orthodontics and Oral Surgery

PUBLISHED MONTHLY BY

THE C. V. MOSBY CO., 3525 Pine Blvd., St. Louis, Mo., U. S. A.

REPRESENTING

AMERICAN ASSOCIATION OF ORTHODONTISTS

New York Society of Orthodontists.
Southwestern Society of Orthodontists.
Southern Society of Orthodontists.
Rocky Mt. Society of Orthodontists.
Alumni Society of the Dewey School of Orthodontia.
Pacific Coast Society of Orthodontists.
Central Association of Orthodontists.
Alumni Society of the International School of Orthodontia.
European Society of Orthodontia.
British Society for the Study of Orthodontics.
Société Française d'Orthopédie Dento-Faciale.
Great Lakes Association of Orthodontists.

EDITORIAL STAFF

H. C. POLLOCK, ST. LOUIS, Editor

Associate Editors in Orthodontics

Oren A. Oliver, Nashville, Tenn.; James D. McCoy, Los Angeles, Calif.; Frank M. Casto, Cleveland, Ohio; Joseph D. Eby, New York, N. Y.; Paul G. Spencer, Waco, Texas; Sheldon Friel, Dublin, Ireland; Russell E. Irish, Pittsburgh, Pa.

Associate Editors in Oral Surgery and Pathology

Sterling V. Mead, Washington, D. C. Kurt H. Thoma, Boston

Consulting Editor, Dentistry for Children—Walter T. McFall, Nashville

Department of Abstracts and Reviews

Associate Editor—J. A. Salzmann, New York City

BUSINESS AND EDITORIAL INFORMATION

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne.

Subscription Rates—Single Copies, 75 cents. To any place in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $8.50 per year in advance. To Canada, $10.00; under foreign postage, $9.50. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, post-office or express money order, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will consider for publication original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal. Original, double spaced, typewritten copy should be submitted.

Opinions—Neither the editor nor the publisher holds himself responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—The publishers will communicate with authors regarding reprints upon publication of papers.

Communications—Contributed articles, illustrations, letters, and all other matter pertaining to the editorial department should be addressed to the editor, Dr. H. C. Pollock, 8022 Forsythe Blvd., St. Louis, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, Mo. All books for review should be sent to Dr. J. A. Salzmann, 654 Madison Ave., New York City.

Illustrations—Such half-tones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements — Objectionable advertisements will not be accepted for publication in this Journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply may be exhausted.

JAN 2 1941

INDEX NUMBER

Vol. 26 DECEMBER, 1940 No. 12

American Journal of Orthodontics and Oral Surgery

PROPERTY OF
DENT
UNIV
DON'T MUTILATE OR
REMOVE

Editor, H. C. POLLOCK

ASSOCIATE EDITORS IN ORTHODONTICS

OREN A. OLIVER JAMES D. McCOY FRANK M. CASTO JOSEPH D. EBY

PAUL G. SPENCER RUSSELL E. IRISH SHELDON FRIEL

CONSULTING EDITOR, DENTISTRY FOR CHILDREN

WALTER T. McFALL

ASSOCIATE EDITORS IN ORAL SURGERY

STERLING V. MEAD KURT H. THOMA

DEPARTMENT OF ABSTRACTS AND REVIEWS

Associate Editor—J. A. SALZMANN

Published by THE C. V. MOSBY COMPANY St. Louis, U. S. A.

COPYRIGHT 1940 BY THE C. V. MOSBY COMPANY, ST. LOUIS

Table of Contents on Page 2

Orthodontists Who Appreciate True Economy Use . . .

Dee "Laboratory Tested" Orthodontia Materials

- DEEPEP WIRE
- DEEORTHO BAND MATERIAL

Oh, yes, the original cost of gold is greater. But think of the benefits that accrue from the use of a precious metal: greater accuracy . . . maximum patient satisfaction . . . complete protection of your own reputation . . . not to mention the joy of working with workable gold.

THOMAS J.
DEE & CO.
Precious Metals
CHICAGO
GENERAL OFFICES AND PLANT 1900 W KINZIE ST.
DOWNTOWN OLD GOLD AND SALES OFFICE 55 E. WASHINGTON ST.

Vol. 26, No. 12, December, 1940. American Journal of Orthodontics and Oral Surgery is published by The C. V. Mosby Company, 3525 Pine Blvd., St. Louis, Mo. Subscription Price: United States, Its Possessions, Pan-American Countries, $8.50; Canada, $10.00; Foreign, $9.50. Entered as Second-class Matter at Post Office at St. Louis, Mo., under Act of March 3, 1879. Printed in the U. S. A.

INDEX TO ADVERTISERS

Please mention "American Journal of Orthodontics and Oral Surgery when writing advertisers—It identifies you

Aderer, Julius, Inc. ---------- 11
American Red Cross ---------- 12
Anacin Company, The ---------- 1

Baker & Co., Inc. ----------A-1
Bristol-Myers Company ----------A-4

College of Dentistry, University of Southern California, Graduate Division ---------- 7

Dee & Co., Thomas J. ------2nd Cover
Dee & Co., Thomas J. --------A-2, A-3

Florida Citrus Commission--------- 7

Gilmer Binder Company ----3rd Cover

Kreis, Karl A. ---------- 4, 5

Malin Company, The---------- 9

National, State and Local Tuberculosis Associations in the United States, The ---------- 14
Novocol Chemical Mfg. Co., Inc., -- 6

Ret. Alter (Orthodontia Specialties) 7
Rocky Mountain Metal Products, Inc. ---------- 4, 5

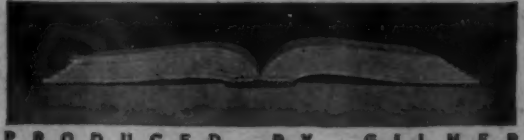
Stratford-Cookson Company ------ 9
Squibb & Sons, E. R. ---------- 3

White Dental Mfg. Co., S. S. ---------- Back Cover
Williams Gold Refining Co. ------- 10

Vince Laboratories, Inc. ---------- 8

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

Make a Real Reference Book of Your Journal



PRODUCED BY GILMER

File each copy as soon as received so it will be instantly available when you want to refer to a recent article. We have secured what we believe to be the best binder made for this purpose. It is light, easy to operate, and handsome, and opens perfectly flat for easy reference.

Sent postpaid on receipt of $2.00, with a guarantee that if you are not more than satisfied, your money will be refunded. The binder holds one volume (12 issues) of this Journal. For 50c extra date and volume number will be stamped on backbone in gold.

Be sure to state that the binder is intended for use with this Journal.

Address Amer. Jour. of Ortho., THE C. V. MOSBY COMPANY

3525 Pine Blvd. St. Louis, Mo.

S. S. WHITE BRACKET BANDS

Invented by Dr. E. H. Angle

FOR THE RIBBON ARCH TECHNIQUE

REINFORCED BAND WITH BRACKET

For use with Ribbon Arch .022" x .030"

Order by

2" x 5/32" x .003" Nickel-Silver ------430XA
2" x 5/32" x .003" Gold Alloy ------G430XA
2" x 5/32" x .004" Nickel-Silver ------432XA
2" x 5/32" x .004" Gold Alloy ------G432XA

NOTE: The .004" is generally preferred on account of its superior strength over the .003".

TINY BRACKET BAND

For use with the Tiny Ribbon Arch Wire when this is employed with the .028" surface toward the teeth.

Order by

Tiny Bracket Band, Gold Alloy only ---------- G434X

FOR THE EDGEWISE ARCH TECHNIQUE

All brackets under this title receive .022" round, .022" square, and .022" x .028" arch wires

ALIGNMENT BRACKET BAND AND STAPLE

[Patented]

For use on anterior teeth Order by

Alignment Bracket, pkg. of 10-- G448
Alignment Bracket Band, 1/8" x 1¾" x .004" ---------- G448X
Alignment Staples, pkg. of 100-- G449

TIE BRACKET BAND

[Patented]

The metal of this bracket is softer than that of the other brackets and the bracket will impinge on the arch wire when the ligature is drawn very tight. This feature is desired by some orthodontists. Made of gold alloy only.

Tie Bracket only Order by number
Package of 10 G447
Tie Bracket Band 5/32" x 2" x .004" G442XA
Tie Bracket Band 1/8" x 1¾" x .004" G447X

ANTERIOR EDGEWISE BRACKET

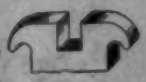
[Patented]

For the Lower Anteriors of Close-Bite Cases

Wings slope sharply to eliminate interference with teeth, especially in close overbite cases.

Gold Alloy only Order by number
Anterior Edgewise Bracket only package of 10----------G458
Anterior Edgewise Bracket Band, .125" wide, 1¾" long, x .004" thick G458X

EDGEWISE BRACKET



[Patented]

For Anterior and Posterior Teeth

This bracket is made of a hard precious metal alloy; it is strong, and will not distort or impinge on arch wire when the ligature is looped about the wings.

Made of Gold Alloy only

Order by number

Edgewise Bracket only, package of 10---------- G452
Edgewise Bracket Band, .125" wide. 1¾" long, x .004" thick---------- G457X
Edgewise Bracket Band, .150" wide, 2" long, x .004" thick---------- G452X

FOUR-CHANNEL BRACKET

End view Side view

[Patented]

For Use on Anterior Teeth Only

Receives .022" round, .022" square, or .022" x .028" arch wires. .007" ligature wire can be laced through eyelets or tunnels for ligating to arch wire.

Made of Gold Alloy only Order by number
Four-Channel Bracket Band 1/8" x 1¾" x .004" thick---------- G451X

Manufactured by

THE S. S. WHITE DENTAL MFG. CO.

211 South Twelfth Street

Philadelphia, Pa.

For Sale at Dental Depots